



Volume 3 Number 23
\$2.95

November 27, 1984

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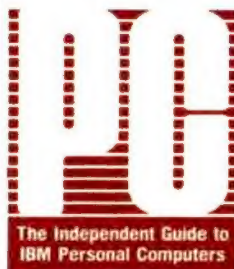
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**The Independent Guide to
IBM Personal Computers**

**VOLUME 3 NUMBER 23
NOVEMBER 27, 1984**



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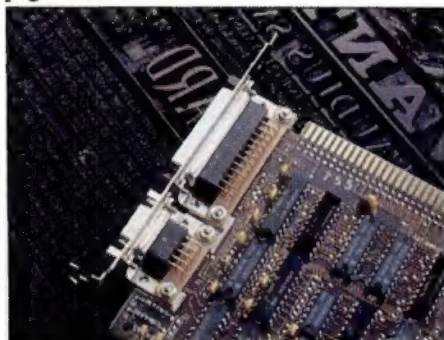
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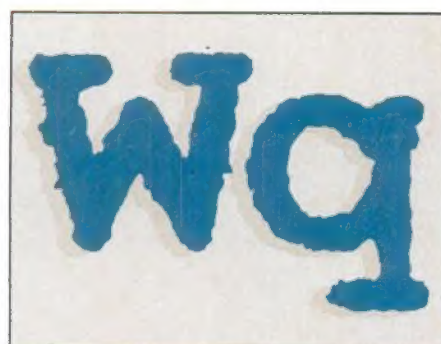
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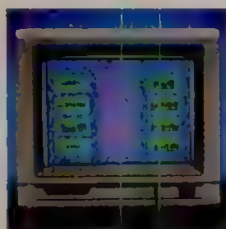
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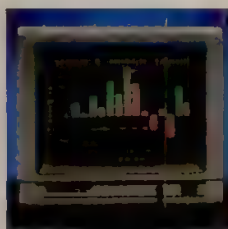
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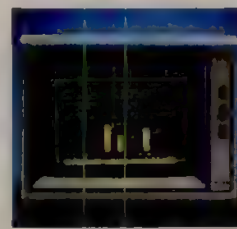
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What's Inside

Assembling, testing, reviewing, and organizing 120 printers was no small task, but the result is an unprecedented survey of an often-overlooked area of computing.

When editor Bill Machrone announced to the editorial staff that this issue of *PC* would encompass a review of every PC-compatible printer on the market, a hush fell on the office. People started doodling, humming, staring out windows, and running to answer silent phones. It wasn't that we didn't want to head up an exhaustive survey of some 120 printers (to the best of our knowledge, the biggest product survey ever conducted). But, well, we had so many other important things to do (like cleaning out our desks, or partitioning our hard disks, or . . .).

For a few minutes, it looked as if there would be mutiny in the ranks. However, Machrone huddled with executive editor Mike Edelhart, and they finally came up with a solution satisfactory to everybody: *PC* would bring in an outside consultant to run the project.

When freelancer John Dickinson showed up at our offices in a pair of blue jeans, we thought we were in trouble. Dickinson is a dress-for-success man from way back, and we had assumed that he would carry the project through in his usual immaculate style. But we soon realized that white shirts and black ink don't make the best combination.

First, of course, the printers had to be rounded up. Dickinson and Edelhart made up a preliminary list of printers,



and editorial assistants Roz Tobias and Dave Baker were put to work calling manufacturers, making shipping arrangements, and generally running up *PC*'s long-distance bill.

It wasn't long before word got around, and Dickinson became known throughout the computer industry as the guy who was collecting printers. Soon, he began getting anxious calls from manufacturers who wanted to make sure they were included. A small mountain of printer boxes began to grow in *PC*'s Toy Shop.

Of course, we couldn't review every printer ever announced. Some turned out to be "vaporware" in the (we thought) inimitable style of software products.

Others had been discontinued, and yet others were from companies that had been discontinued.

Once the printers started pouring in, Dickinson (with the help of college student Stephanie Beuchert) organized the test software (written in compiled BASIC) and script (7,500 words of it). And now it was time to bring on all the reviewers.

Naturally, when you have that many pieces of hardware to review, the first thing to do is find somewhere to put them—and people to review them. Space for authors to work in was arranged for in a temporarily unused hallway area of *PC*'s new offices. As a result, visitors on their way to the sales department were often nonplussed to find themselves suddenly in the midst of an equipment-testing lab.

Unfortunately, all was still not smooth sailing. The area set aside for sound testing had too much ambient noise, and the Ariel sound-wave analyzer gave us some trouble.

Waiting until everyone went home put a bandaid on the ambient noise problem, and technical editor Craig Stark's daughter fixed the Ariel program. But it was clear that the sound testing would have to be moved.

Dickinson finally settled on the Toy Shop's back storage room—where we

WHAT'S INSIDE

had already stored some 80 or so printers. Moving Day was unofficially declared, and all available hands were drafted.

It soon became obvious, at least to the reviewers, why John was appearing in mufti. A Diablo color ink jet printer made Jim Forney look as if he had been

attacked by a drunken tattoo artist. Charles Petzold and Phil Wiswell, both of whom are slight of build, looked incongruous wrestling with the biggest printers in the batch. Robin Raskin, who had to practically dissect two printers when they showed up without any instructions whatsoever, had the good sense to wear overalls.

Reluctant Recruits

As the testing went on, we became used to watching John running back and forth through the offices rounding up recalcitrant authors or searching for technical assistant Michael O'Cone or executive editor Paul Somerson. It wasn't too long, however, before Dickinson found a foolproof way to acquire staff assistance: he would stroll down the hall muttering, "This one will make Somerson give up his 2140 for sure." Everyone came running.

Meanwhile, at least one of our assistant editors, Fred Paul, discovered that, although Dickinson was heading up the arrival and dispersal of printers and authors, *somebody* had to take responsibility for editing, routing, and keeping track of the manuscripts—and that he had been elected. Needless to say, the job was done in top form.

There were, of course, the usual last-minute jitters about whether we had included enough data to satisfy our readers. (We have found that you are not in the least shy about letting us know about any mistakes or omissions.) Our fears were put to rest by David Stone, who was called in at the last possible moment to select our coices for the best of the fully formed character printers. David is a very careful (read: picky) person, and he approached the problem with some trepidation. You see, he felt he might not have enough information to do the job properly. But after reading the reviews and studying the charts, even David was satisfied that he could make well-informed choices.

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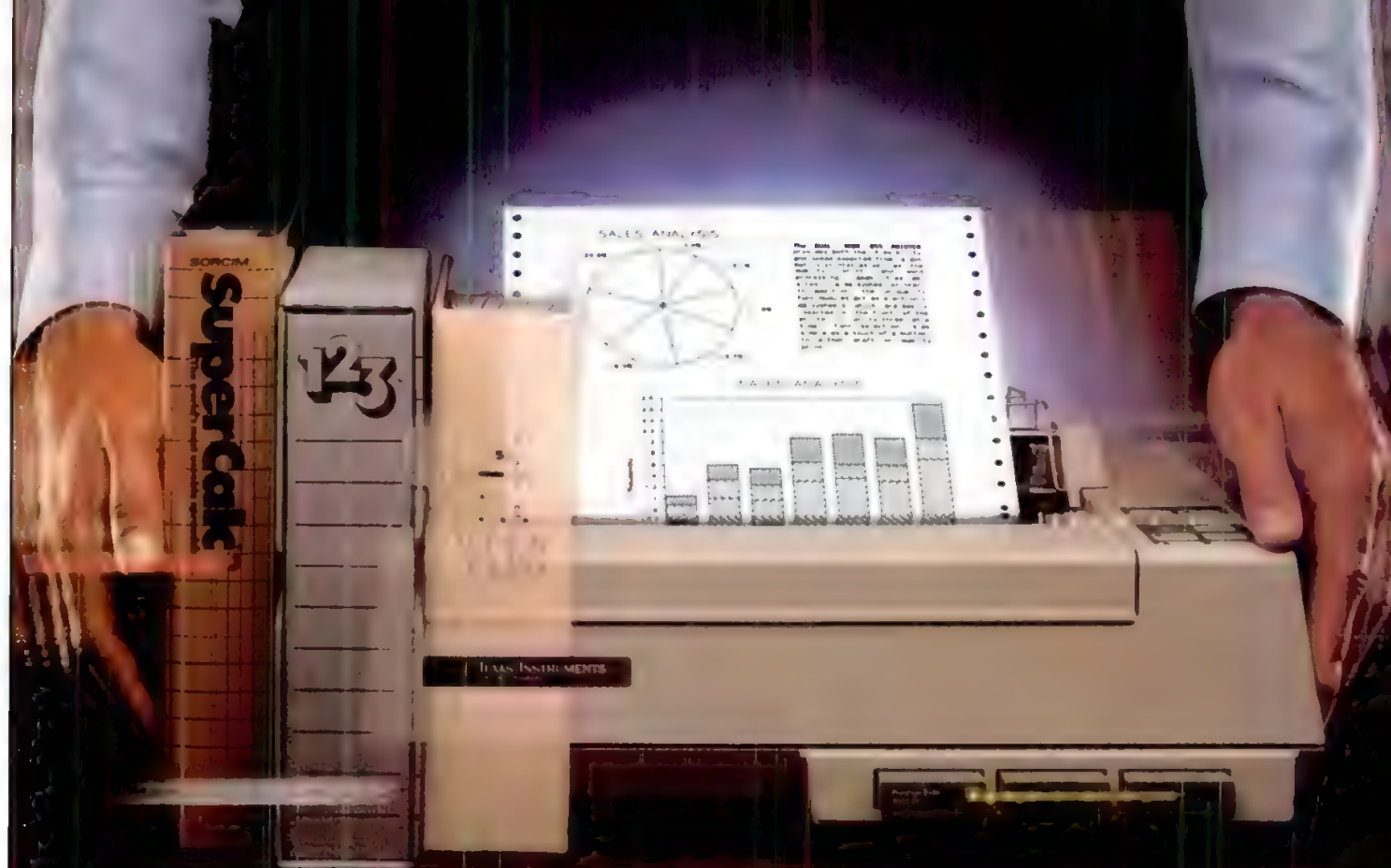
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It's a long list of capabilities which make for an extraordinarily powerful product. In fact, Halo is so good that manufacturers of graphics boards and systems are adopting it as a standard graphics language. So it can bridge your application to other systems. CAD-CAM developers, especially, have embraced its device-independent approach for maximal portability.

Halo is a dazzling demonstration of why C has become the language of choice among programming professionals: its function library architecture means you can tremendously enhance your firepower by acquiring libraries of software like Halo with dramatic economy of time and money.

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PLINK86

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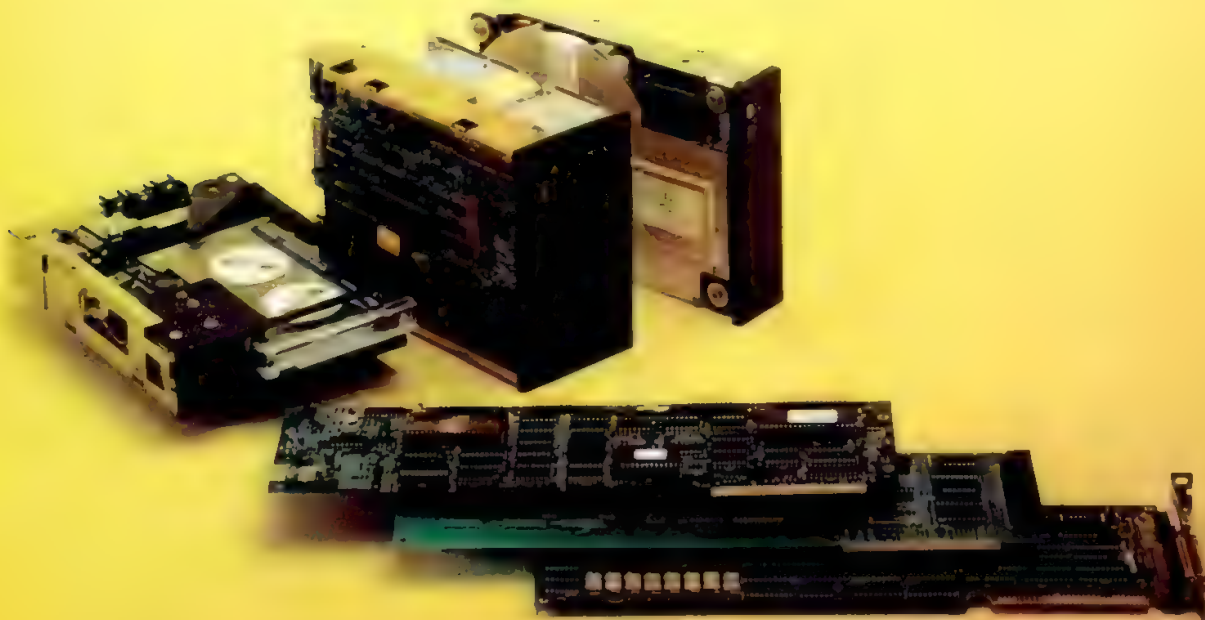
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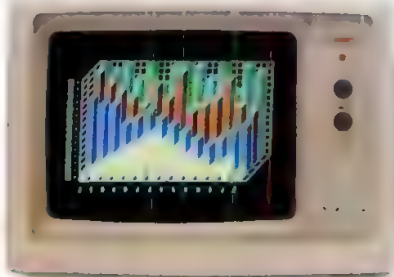
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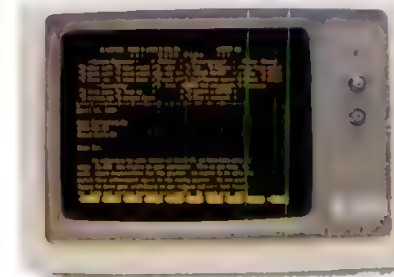


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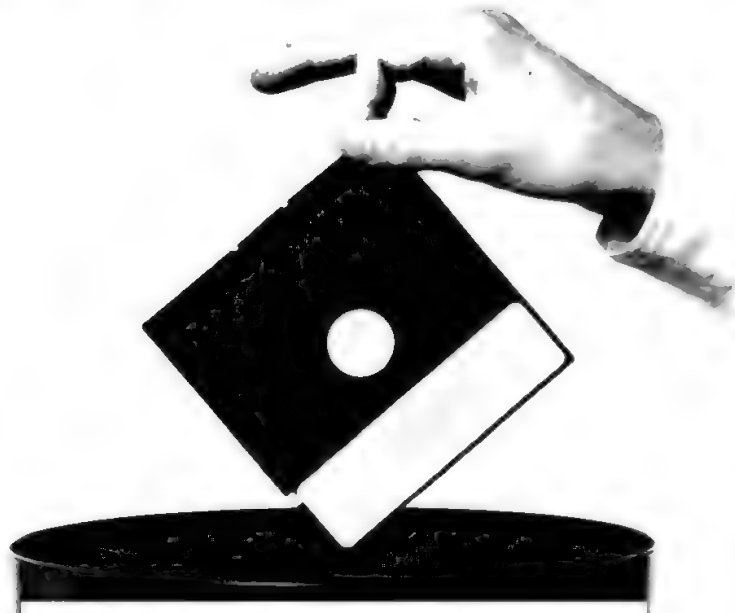
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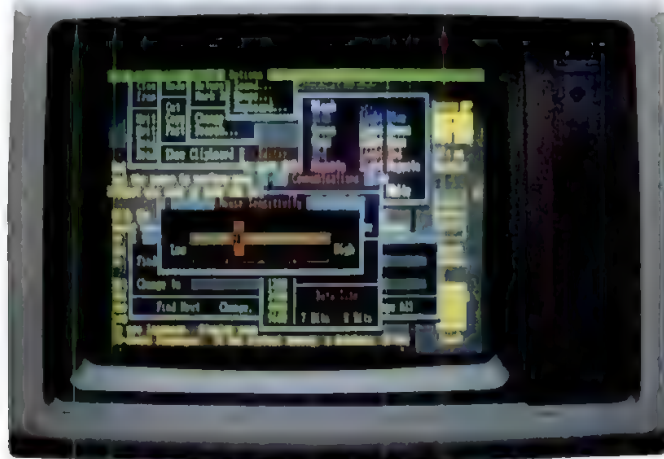
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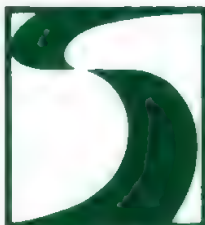
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IBM News

FROM THE EDITORS OF PC

NOVEMBER 27, 1984

IBM Launches Major Business Software Blitz

Thirty-one new software products are offered to meet every business need.

BY DON KENNEDY

NEW YORK—In early September, IBM served up a software appetizer of over 30 programs, most of them relatively minor. But by the end of the month, the company had wheeled out the main course—nearly three dozen new software packages able to perform virtually every function for which PCs are normally used in business—from accounting, payroll, and inventory to data management, spreadsheet analysis, word processing, and report and graph generation. Big Blue even introduced software to link its microcomputers to its larger System 36 and System 370 machines.

While this poses no real threat to such established software publishers as Lotus or MicroPro, many smaller software developers are concerned that after IBM chomps its way through the market, all that will be left for them will be the crumbs.

IBM categorizes its new software into two "families." The Business Management Series consists of a number of separate accounting programs that can create files compatible with all of the other programs in the series.

The other "family" is called the Personal Decision Series, and all the programs under this umbrella have at their core a database program called *Data Edition*. These programs, sold separately, include spread-

sheets, a word processor, a report generator, graph programs, and software to link PCs with IBM Systems 36 and 370.

The programs of the Personal Decision Series are compatible with those of the Business Man-

agement Series, meaning that users will now be able to quickly and efficiently transport information from one program to any of the others. All in all, the combination constitutes a nearly

(continued on page 59)

EXCLUSIVE

A New WordStar Is Born

The world's best-selling word processor now boasts windows, an on-line spelling checker, proportional spacing, and more.

BY STEPHEN MANES

SAN RAFAEL, Calif.—It may be called *WordStar 2000*, but MicroPro International product manager Leigh Marriner told PC in an exclusive interview, "It is entirely new. There isn't a line of *WordStar* code in it."

MicroPro's just-announced top-of-the-line word processing package integrates all the power of *WordStar*, *MailMerge*, and *CorrectStar* into a single massive program along with a broad range of additional functions. But MicroPro president and CEO Glenn Haney sees ease of

use as the most important feature of the new program: "*WordStar 2000* has the entire range of accepted and expected features and functions and is very easy to approach, easy to learn, easy to remember, and easy to use."

"We've tried to build something that really is easy," Marriner emphasized. "We've used the user interface research coming out of IBM and Xerox PARC. And we've been able to benefit from our years of *WordStar* experience. We actually

took all that data from 5 years of users' letters and were able to identify which of the features people really want most and what their biggest complaints are."

State of the Art

WordStar 2000's capabilities put it in the front rank of the current generation of word processing programs. *2000* will display as many as three documents at once, perform four-function math, sort lines into al-

(continued)

WordStar 2000 (continued) phabetical order, emulate a typewriter, recognize 30 user-customized function keys, store hundreds of keystrokes under mnemonic monickers in user-created glossaries, suggest the correct forms of wildly misspelled words, and hyphenate lines automatically as they're typed in.

Dynamically renumbered notes are available, too, though the program's initial release offers only endnotes on the final page of the document rather than true footnotes appearing at the bottoms of pages. Context-sensitive on-line help screens are available at all times.

Paragraphs reform automatically, correct pagination is available at all times, and tabbing, indentation, and margin data remain with the document. Underlining and boldfacing are displayed correctly on monochrome monitors; other print enhancements (strikeout, superscripting, and the like) are displayed via inverse video. On color screens, all print enhancements are displayed in tints chosen by the user at installation time.

Additional Features

Cursor commands offer movement by word, sentence, and paragraph as well as to a particular page. Paragraphs and sentences can be deleted without marking them as blocks, while an undo buffer allows restoration of the most recent deletion of more than a single character at a time.

WordStar 2000 offers printer drivers for at least 60 printers (including laser models) in 90 different configurations. It supports true proportional spacing and the full IBM extended character set for printers that can handle them.

WordStar 2000 Plus adds features some users may not want or need. A menu-driven table-of-contents and indexing package goes beyond the capabilities of the current *StarIndex*. A dedicated mailing-list database function integrates with mail-merging features. A communications program much like *TelMerge* emphasizes ease of use rather than a wide variety of functions. The *Plus* package

will be available separately for those who wish to upgrade after buying the basic program.

What's Missing

WordStar veterans may wonder what's changed in the new program. Answer: The now-classic control-key editing commands are different, and the often-mysterious dot commands are gone. Their functions are still available, but they appear in easier-to-fathom guises.

In a world increasingly committed to mice and function keys, *WordStar 2000* boldly continues its forebear's Ctrl-and-letter key and help-when-needed pop-up menus, but with some significant differences. All key combinations are now mnemonic.

Block commands in traditional *WordStar*, for example, begin with Ctrl-K; in *2000*, they start with the more reasonable Ctrl-B. Only *WordStar* fanatics are likely to miss such arcane commands as Ctrl-QA for find-and-replace; it's now Ctrl-L (for Locate), and prompts step you through the rest.

New Menus

The notoriously cluttered *WordStar* menus have been cleaned up and given breathing room with judicious use of blank space and rules. One result is that all available options can't be displayed at once; the user must tap the space bar to toggle between menus. To make room for extra features, some *WordStar* commands now require an extra keystroke in

2000.

The old dot commands have been replaced by a menu-driven approach to such things as headers, footers, margins, and merge-printing. To enter a header in *2000*, for example, the user simply presses a two-stroke control-key sequence and types in the proper information on the screen between markers clearly indicating [HEADER].

Multiline headers and footers are now possible, and the system time and date can be placed in them automatically. Merge-printing to chain documents or create personalized mailings has also become largely menu-driven.

A "format sheet" attached to each document at the time of its creation now does most of the page-formatting work. Controlling such things as margins and page offset, format sheets can be stored, modified, and called up at the touch of a key to change the appearance of a document.

Although *2000* can produce pure ASCII files, its formatted documents have a structure completely different from those produced by original *WordStar*. A conversion utility to convert files in either direction is supplied with *2000*, and an extensive on-line tutorial gets new users up and running fast.

Custom Installation

In keeping with tradition, *2000*'s installation allows the user wide latitude in customizing the program. Supplied batch files help new users make use of the path and subdirectory ca-

pabilities of DOS versions 2.0 and later, which are fully supported by *2000*.

The initial release of *WordStar 2000* will be for PC-DOS only. Since the program was developed in the C language in a UNIX environment, portability to other operating systems (such as the forthcoming XENIX for the AT) should be relatively simple.

As the world's best-selling word processing program (more than 1,200,000 copies around the world), the freely copiable *WordStar* has undoubtedly become the world's most pirated program as well. *2000* will be copy protected, but details were not available at press time. Haney did promise that the company's major criterion for the copy-protection scheme is that "it must not give the user a hard time. Most of the products are user-unfriendly as hell and they really create a lot of problems."

Ivan the Good

Code-named "Ivan" (*WordStar* originator Seymour Rubinstein's middle name), the new product requires 256K RAM, 2 disk drives, and a PC or compatible machine. MicroPro recommends a hard disk as well, and with good reason—although the main portion of the program fits on one floppy disk, the whole shebang (including the tutorial) takes up six floppies.

WordStar 2000 is priced at \$495; *WordStar 2000 Plus* costs \$595. An upgrade will be available to any registered user of any IBM version of *WordStar* for \$250 with the return of the original serialized disk.

Will original *WordStar* become an orphan? Not according to Haney. "*WordStar 2000* is not a replacement for *WordStar*. It does not kill *WordStar* off, nor is it planned to." In fact, said Mariner, "We're lowering the price of *WordStar*. We're doing a lot of work on various areas and will continue to release updates. We have a sizable research group working on the next release. *WordStar* will become the product for people who don't think they need all the latest features."

Speaking of Computers: More Is Less

"The PC AT, far more than a high-tech hot rod, is the embodiment of IBM's commitment to the New Deal movement in the face of rampant Reaganism.

"Small companies, struggling in a world dominated by big business, can now buy a megabyte of PC AT main memory from IBM for \$2,250. Larger concerns, far more able to survive in the world of business, pay IBM, for the same amount of main memory on a 4300, \$7,500. And the strongest corporate creatures, even though they need much more memory, are taxed for each megabyte added to a 308X, under IBM's New Deal, \$20,000."

Computer and Communications Buyer newsletter
September 1984

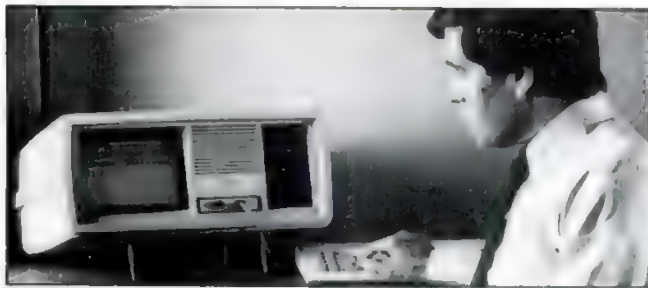
News In Brief

Eastern Fakers... Responding to a request from the IBM Taiwan Corporation, a subsidiary of IBM, police in Taiwan have seized counterfeit IBM computer equipment from two computer manufacturing companies in Taipei, Taiwan. According to an IBM spokeswoman, in Armonk, New York, a provisional seizure has been filed against the Taiwan Mycomp Corporation and the Lyicheng Computer Company for possession of all personal computers, disks, motherboards, and manuals illegally bearing fake IBM logos and trademarks. IBM says it suspects other companies in Taiwan of similar illegal practices and has urged them to stop infringing on the IBM trademark.

Advanced Pictographics?...The six newest authorized IBM dealers are located in Peking, China. And IBM has launched a major sales effort in that country by introducing the **Model 5550**. It's a desktop computer that uses Chinese characters and will sell for about \$10,000, plus shipping and import duties. Existing hardware was altered and new software was developed to accommodate the complex Chinese alphabet.

East Comes West... While the 5550 is being built for IBM by its subsidiary in Japan, Japanese companies are launching plans to locate facilities in the Far West. **Fujitsu Ltd.** has committed to build two plants in the Portland area, one for semiconductors and another for PC-compatible disk drives. Earlier this year, **NEC Corp.** of Japan announced plans to build a fiber-optics plant in the Portland area.

Birth Announcements... Sperry Corporation Computer Systems has introduced the **Sperry Portable Computer** as the newest addition to its line of personal computers. The 38-pound, transportable computer features built-in interface capabilities, such as a RS-232C serial port and a parallel printer port on the mother-



The Sperry Portable Computer.

board, as well as a 9" wide-view screen for high-resolution graphics. Sperry's portable uses MS-DOS 2.11 and GWBASIC and is said to be compatible with the IBM PC.

The Portable has 256K RAM and is expandable to 512K RAM on the motherboard and to 640K RAM via an expansion board. The system uses an Intel 8088 microprocessor, running at 4.77 Mhz. Sperry says its new portable will incorporate the graphics, the memory, and floppy disk controller on the main system board, enabling up to four expansion slots to remain open.

The Sperry Portable is available in three models. The Model SP1 has a single floppy disk drive and costs \$2,685. The Model SP2, with two floppy disk drives, goes for \$3,110. The Model SPX has a single floppy disk drive and a 10-MB hard disk drive and sells for \$4,985.

Sperry is located at P.O. Box 500, Blue Bell, PA 19424, (215) 542-4213.

The Ultimate Corporation is expected to enter the IBM PC/XT-compatible entourage by introducing a personal computer. The new computer will have both Microsoft's MS-DOS operating system and the Pick operating system, which the company markets with its larger systems. With the Pick operating system, the computer will feature multiuser capabilities, but it will not be compatible with the IBM PC AT. However, an AT-compatible computer is brewing in the future, according to company sources. The Ultimate Corporation is located at 77 Brant Ave., Clark, NJ 07066, (201) 388-8800.

The High-Tech Road to China



The Shanghai Software Consortium, a group of Shanghai, China businessmen and civic leaders, traveled to America recently in an attempt to secure jobs for their citizens. Typical labor rates there for software development are \$15 an hour; they hoped to use this low cost to attract American contracts for their city.

Troubled Times... When Ovation Technologies, of Norwood, Massachusetts, announced a delay in shipping their integrated software, we spoke with company President Tom Gregory and learned of some hard times ahead for Ovation staffers. More than half of the company's staff had been laid off. Gregory said the product's development was "more complex" than they had anticipated, due mostly to "noneffective technical management." Gregory anticipates that the program will eventually be released and hopes to rehire the laid-off staffers.

Flight Stimulators... By the end of 1984, **Avicom International**, of Pasadena, California, will have its computerized entertainment system flying the friendly skies on **American Airlines**. The Sky-Q system will allow passengers to use their own individual electronic game units during flights.

According to Joe Stroop at American Airlines, Avicom will specially design a computer-controlled wall rack, which will dispense the games, automatically recharge the unit's batteries, and calculate charges for renting the game.

Al Shilton, vice president of new product development at Avicom and creator of the Sky-Q system, says several popular games will be available on American flights, including Ms. PacMan, Scrabble, backgammon, Donkey Kong, Frogger, poker, and rummy. He says that although American is the first airline to sign an agreement allowing Avicom to provide Sky-Q games in flight, many more airlines, including TWA, Air Canada, and World, have expressed interest in the system. They also have plans to introduce their mobile games to cruise lines and hospitals.

Both Shilton and Stroop say they are satisfied that the Sky-Q system will not cause any electronic interference aboard the aircrafts.

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 - Forward Surge Rating @ 25°C, 1440 Amps For 1/120 Sec.

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EMERALD SP-2

Switched surge protector; plugs into duplex outlet; 6 ft. power cord with built-in circuit breaker/switch; six outlets.

\$59.95



SAPPHIRE SPF-1

Switched surge protector; EMI-RFI filtered; adapts duplex outlet; three outlets.

\$79.95



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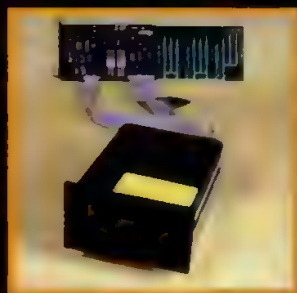
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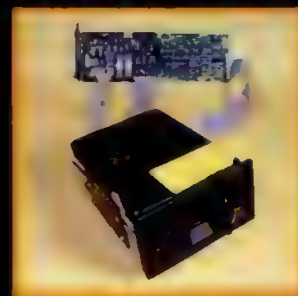
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PRODUCT REVIEW

IBM Auditions Five Phone Programs: Are Any Worth a Callback?

BY TOM BADGETT

Telephone directories are featured in five packages in IBM's initial release of 36 Personally Developed Software products. (For more about this series of programs created by IBM employees and their families see "IBM Floods Market with Low-Cost Software," *PC*, Volume 3 Number 21, page 33.)

Why did IBM release so many different phone directory packages? Is a lower price the only difference between IBM's "Productivity Family" phone directory and its "Executive" models? The following reviews should answer these questions.

Unlike the game, educational, and utility programs reviewed in previous issues (see *PC*, Volume 3 Number 21, page 39 and Volume 3 Number 22, page 39) none of the following programs are included in any IBM "Value Packages," which bundle several related programs at a discount price.

Personally Developed Software is available through some IBM Product Centers and from IBM's authorized dealers. These programs and a free catalog describing all 36 packages can be ordered by writing to IBM, Personally Developed Software, P.O. Box 3280, Wallingford, CT 06494. For phone orders, call (800) 426-7279.

Phone Directory On-Line

by Tony Drumm and Clifford Spinac

List Price: \$24.95

Requires: 128K, DOS 1.1 or later, (modem is optional).

Print Buffer On-Line

by Alan Jones and Tony Drumm

List Price: \$19.95

Requires: 128K, DOS 1.1 or later.

Phone Directory & Print Buffer On-Line

List Price: \$34.95 (combines above two programs)

This pair of RAM-resident utilities can be habit-forming. With a 128K system, you have immediate access to about 1,000 names and telephone numbers, a phone dialer, and a programmable appointment alarm, plus you can print long documents—all while you run a spreadsheet, word processor, or other applications. The phone directory takes up about 10.5K RAM before you start adding names. The print buffer uses 2K beyond the size of the buffer, which can be 1K to 62K (a 16K buffer is standard).

Although these programs are

sold separately, I suggest you don't buy them that way. Without the phone directory, you'd have to access a disk-based program to control the print buffer. In the version with a phone directory, both programs reside in RAM and no disk access is needed.

The *Phone Directory On-Line* includes routines that help you create a telephone directory and maintain it. They work well with screen highlighting (in color, with a color display), ample screen prompts, and error messages.

Each directory record includes a last name, two initials, a telephone number (up to 20 numbers in four formats), a five-number extension, and a 28-character comment field. If you enter a last name that is already on file, the editor lets you cancel that entry, delete the duplicate, or change the initials and number to create a separate entry.

A separate routine loads the directory into RAM and returns you to DOS. Then, by pressing Alt-Tab, you can look up a name or number, set an appointment reminder, or dial a number. You can search for numbers by last name or by entries in the comment field. If you have an auto-dial modem attached, the utility dials the chosen number for you. When you exit the directory program, the original screen you were working on is restored.

Print Buffer

If you have installed the *Print Buffer On-Line*, a buffer command menu is also displayed at the bottom of the screen when you press Alt-Tab. The menu lets you clear the buffer, start and stop printing, reprint the last page, reprint the entire con-

tents of the buffer, and advance the printer to top of form. A running display shows how many characters are in the buffer as it is printed.

When I tried to install the print buffer before loading the phone directory, the system locked, and I had to turn off the computer to regain control. Likewise, if you have installed the phone directory program but attempt to add new names with the editor afterwards, you'll lock the system and will have to reboot. These problems aren't documented. Also, if you load PDO (the file name for phone directory program) and the name and phone number file isn't found, a message appears—PDO [/I] [/P] [/M]—which shows possible loading options. I tried running PDO with the /I switch and was told that is an "unknown option." The program claims to work with the /P and /M switches...but what do they do? The documentation doesn't say.

However, once you waded through the poorly-documented (and often undocumented) installation procedures, these two utility programs become a useful and convenient addition to DOS.

Executive Phone Directory

by Charles W. Evans

List Price: \$34.95

Requires: 128K, DOS 1.1 or later (asynchronous adapter and autodial modem are optional).

Executive Phone Directory with Message Feature

by Charles W. Evans

List Price: \$39.95

Requires: 128K, DOS 2.1, IBM Cluster Program and Adapter (asynchronous adapter and autodial modem are optional).

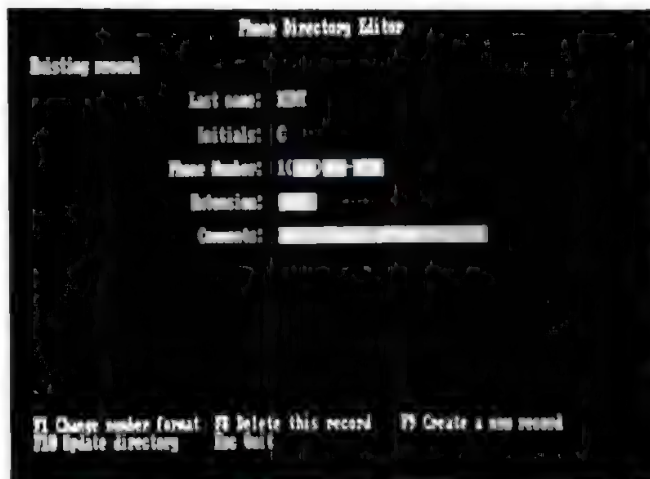
Executive Phone Directory: Build Your Own

by Charles W. Evans

List Price: \$149.95

Requires: 128K, DOS 1.1 or later, two disk drives (one may be a hard disk).

Programs in IBM's *Executive Phone Directory* series support
(continued)



Phone Directory On-Line

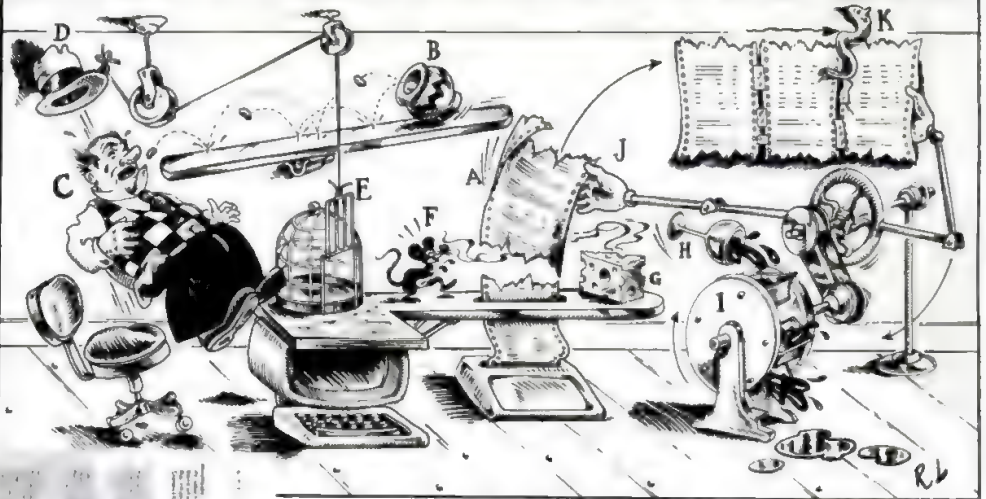
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IBM Phones (continued)

a number of directory and list formats and provide micro network and micro-to-mainframe links. The *Executive Phone Directory*, *Executive Phone Directory with Message Feature*, and *Executive Phone Directory: Build Your Own* work together or separately to provide telephone number retrieval and dialing, mailing label and list printing, and downloading of large mailing or phone lists from mini or mainframe computers.

With each of these packages, you can retrieve records using any information from the first or last name of the person you're seeking. After you've entered two characters of either name, a file search begins. Ten records at a time are displayed: you can either scroll through the file with the cursor movement keys or give the software more information to narrow down the search. Information retrieval is fast, even with relatively large files.

Personal Directory

The *Executive Phone Directory* alone will build and maintain relatively small telephone lists—up to 500 records. IBM calls these "personal" directories. With the *Build Your Own* utility, in a version sold separately, you can download large mailing and phone lists for very fast access at your micro workstation. Or you can extract phone list information from other types of external files (files maintained for other purposes—accounts receivable, for example—on another computer). A single 360K floppy holds up to 8,000 records in this indexed format. Because extremely compact storage is used, editing of these files within the *Executive Phone Directory* is limited. You can't change the last name of an entry or the length of the record (variable-length records are used for compact storage).

The message feature adds the ability to send and receive typed messages—or records from the phone directories—over an IBM Cluster connection. (The IBM Cluster's adapter and software are required to use this fea-

ture.) Each station in a cluster keeps a list of other cluster members by user name or other identification. You select a message receiver from a menu. You can insert "canned" phrases such as "Returned Your Call" and "Please Call" into your message along with a phone number or other directory information. You may also type your own message with the list file editor, which is a functional text editor utility that's part of the

is used to construct *Executive Phone Directory* files from external data. This is a powerful and useful feature—if you need it. But the procedure for building these files is necessarily complicated, since the *Executive Phone Directory* can work only with files in its own special format, and it has no way of knowing what types of files the user will want to merge. The BUILD utility can construct *Executive*-type files from nearly

tures of the *Executive* series programs, but it is easier to set up and use.

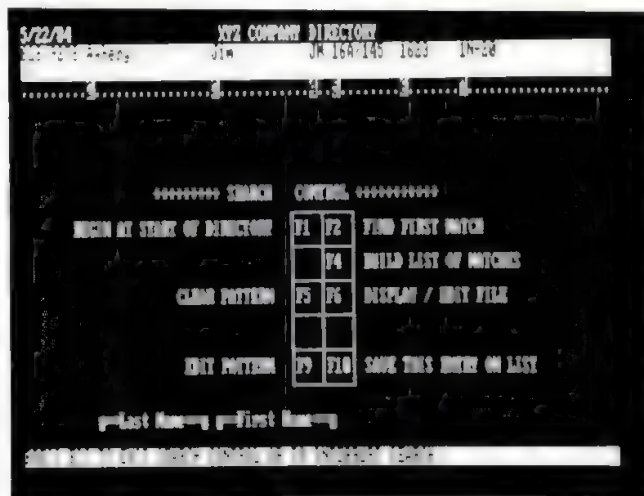
For larger files, networks, and companies that need to use mini or mainframe data files at micro-workstations, the *Executive* packages would be useful. Companies with large computers are likely to have full-time data processing personnel available—an essential factor in handling this software's terse documentation and rigid file structure.

Handle with Care

You'll probably want to print the software documentation so you can refer to it as you work. Like other packages in this Personally Developed Software series, there is no formal documentation, but there's an on-disk file you may scan on the screen or print for a permanent record. Unfortunately, the documentation attempts to mirror exactly what you'll see on the screen, including the graphics symbols, so you'll get lots of strange characters on your printer, unless, of course, you're using an IBM-supported dot matrix printer. This sometimes makes it hard to tell exactly what key sequence is expected as you read the instructions.

You also have to stay alert as the instructions talk about PHONE and PHONE-M programs as if they were the names of the files you'll use with *Executive Phone Directory*. Apparently these names are used in a generic sense because the main program—and really the only one you need to remember—is called simply PM. PHONE, and PHONE-M files aren't on the disk we reviewed.

We suggest you purchase the *Executive* series only in consultation with a knowledgeable and helpful dealer or with the help of your in-house MIS department. This is a very rigid package to set up and use. The structure won't fit into every business and the documentation isn't easy to follow. However, on the other hand, the packages are powerful and the price is reasonable. For the right installation, these are excellent choices. ■



Executive Phone Directory

Executive Phone Directory. Select the "send" option and your message is sent along the cluster to the station you specified. In a fully computerized office where nearly everybody is hooked up to the cluster, this process could be an efficient way to route information.

You can print your complete phone directory or select portions to print as a set. For example, you might want to print a list of everybody with a certain department code or only those people with a specified telephone number prefix.

You can also select a mailing label format for printing your ASCII list files. These files may be constructed with just about any word processor or text editor and then printed from within the *Executive Phone Directory*.

Hard to Learn

While the software adds extra power to any IBM-compatible PC (even the PCjr), the documentation isn't the easiest we've seen to follow. The *Build Your Own* utility, for example,

any external format, as long as you can tell it, step-by-step, how to make the conversion during the download process. The aforementioned feature requires intimate knowledge of your external file structure and what the phone directory expects in its own files.

Fat Files

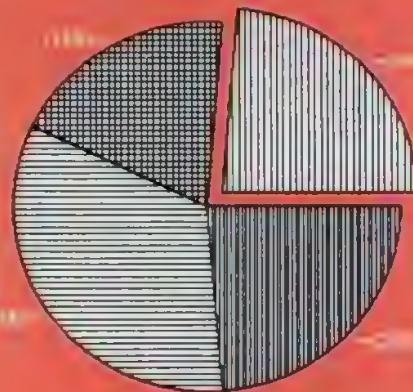
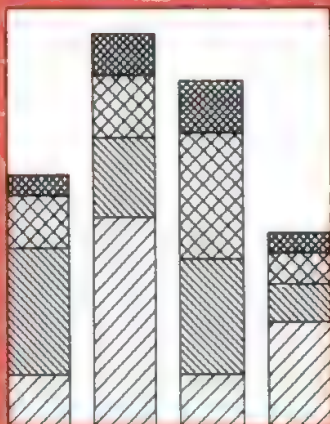
The structure of the software feels more like a big machine than a micro. Record structure, for example, is very prescribed. While there is some screen direction in building the personal or unindexed directories, you're on your own to remember the proper format for the list and message files. The large, indexed files, can only be used with the separate BUILD utility, so if you really need files bigger than 500 records, you'll need this additional software. Indeed, we recommend that if you need lists smaller than 1,000 records, you should choose the less expensive *Phone Directory On-Line* utility. It doesn't offer some of the fea-

We apologize for our evasiveness. After our last advertisement, many of you felt compelled to contact us regarding the implication that The Shoebox Accountant is completely integrated on a single disk. Although we would like to confirm that a single disk holds general ledger, accounts receivable, accounts payable, and payroll modules, queuing files, and the powerful reporting capabilities for which CYMA Corporation is so well known, and offers the entire program for a mere \$395, modesty prevents us from doing so. As ever, we prefer our same, subtle approach.

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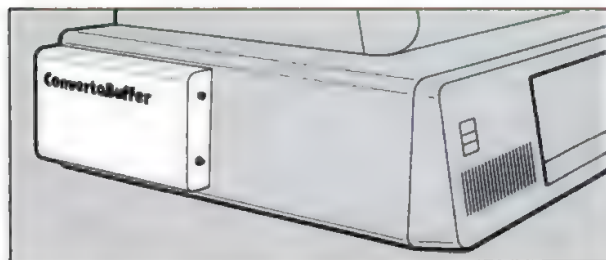
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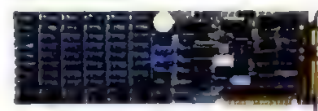
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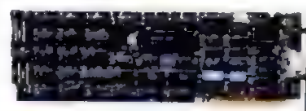
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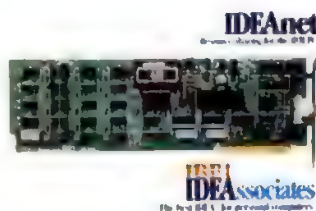


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CIRCLE 478 ON READER SERVICE CARD

Japan Big Winner In Printer Wars

Low cost and available components assist the capture of America's printer market.

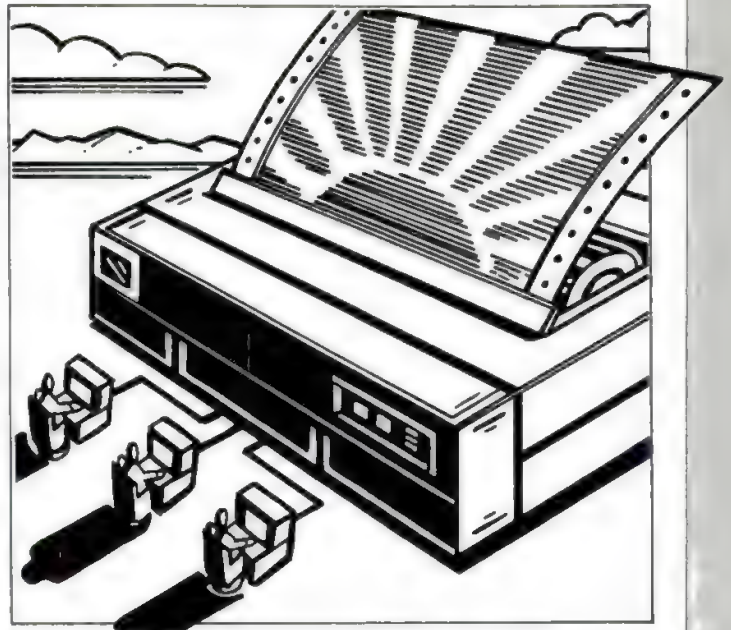
BY JOHN DICKINSON

NEW YORK—Domestic automobile manufacturers have been complaining for years about the "Japanese Invasion" of their market. They will find little comfort in the PC-printer market, where the Japanese have nearly won the war. Out of 119 printers tested in this issue of PC, 73 (over 61 percent) were made in Japan. Of the rest, 32 (27 percent) were produced domestically and 14 (12 percent) were made in other countries.

Some printers that can legiti-

mately be labeled "Made in the USA" contain major components manufactured in Japan. For example, Hewlett-Packard's Laserjet is based on a copier made by Canon, and Diablo's EPM-1 thermal transfer printer is based on a copier made by Fuji. And that's not counting the myriad of Japanese-made electronic and mechanical bits and pieces found in virtually all printing and computing equipment.

Brand names are not much of



a guide to where a printer is made. While it's no surprise that Okidata and Fujitsu printers are manufactured in Japan, American-brand printers such as IBM, Centronics, and Smith-Corona (SCM Corporation) are also made there. Many people think Epson is an American company, but it's actually a subsidiary of Seikosha, one of Japan's—and the world's—largest companies.

Price is a much better guide to where a printer comes from. Nearly all low-priced printers are made in Japan, and the average price of the Japanese printers is more than \$300 below the average of the other printers reviewed. The difference is even more remarkable since several Japanese printers cost more than \$2,000.

In most cases, American-made printers are the costliest on the market. Only a few budget-priced printers are made domestically, and the average price of an American-made printer is almost \$1,000 higher than the Japanese average, and \$500 higher than the average price of printers made in other countries.

The trend toward Japanese printers spans all types and technologies of printers. The fully-formed-character category of printers is dominated by Japanese models, with 71 percent hailing from Nippon. Next in line are black-and-white ma-

trix printers (67 percent Japanese) followed by color printers (58 percent Japanese). All of the advanced technology printers tested were nominally manufactured domestically, but they contained major Japanese components.

Of course, lower prices don't mean inferior products when it comes to Japanese printers. Many Japanese printers were rated as the best in their class and price range.

Domestic Moves

What are American companies doing about the invasion? Printer manufacturers don't wield the kind of clout in Washington that auto makers do, so getting trade protection is probably out of the question, especially with so many public officials pushing for cheaper computers (and therefore printers) for school, in-home, and educational uses.

The result is that an increasing number of American companies are moving their manufacturing facilities offshore. Smith-Corona has given up domestic production and is producing its new line of dot matrix printers in Japan. Centronics is re-entering the printer business with Japanese-made products, and newcomer Primages has gone to Taiwan.

Some stalwarts are holding out. Dataproducts, for one, has

(continued)

Number of Printers Tested
by Type and Country of Manufacture

Printer Type	All	Japan	USA	Other
Advanced Tech.	2	0	2	0
Color	12	7	4	1
Fully Formed	38	27	6	5
Dot Matrix	67	39	20	8
Total	119	73	32	14

Percentage of Printers
by Type and Country of Manufacture

Printer Type	Japan	USA	Other
Total	61.3%	26.9%	11.8%
Color	58.3%	33.3%	8.3%
Advanced Tech.	0.0%	100.0%	0.0%
Fully Formed	71.1%	15.8%	13.2%
Dot Matrix	67.2%	34.5%	13.8%

Average Printer Prices

Printer Type	All	Japan	USA	Other
Advanced Tech.	\$3,745	—	\$3,745	—
Color	\$1,266	\$ 890	\$1,929	\$1,250
Fully Formed	\$1,325	\$1,128	\$2,060	\$1,604
Dot Matrix	\$1,232	\$ 886	\$1,795	\$1,442
All Types	\$1,308	\$ 979	\$1,983	\$1,474

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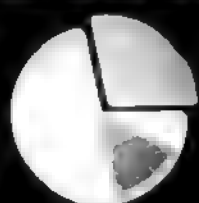
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Printer Wars (continued)

no intention of making its printers in Japan. The world's largest printer company has off-shore facilities in Hong Kong and Mexico for producing components, but at a recent press briefing in New York, Data-products's Printer Marketing Vice President, John Leggat, firmly vowed to keep the company's facilities out of Japan.

Others are holding out, or

starting out, with lines of high-priced domestically produced printers. Newcomer Printek has manufacturing facilities in Benton Harbor, Michigan; Anadex makes its printers in Camarillo, California; and North Atlantic Qantex is settled on Long Island, New York. A pleasant exception is Practical Automation, which makes an inexpensive high-speed matrix printer in Connecticut. ■

Copy Protection: A Case of Overkill?

Vault Corporation's Prolok Plus causes pirates woe and industry debate.

BY CHARLES BERMANT

WESTLAKE VILLAGE, Calif.—There's more than one way to make a pirate walk the plank.

For many software producers, piracy of their programs is a major economic concern. In a medium where months or years of labor can be duplicated as easily as typing COPY*., some software developers have lately been using sophisticated protection schemes to prevent their work from becoming pirate booty on the high-tech seas.

Vault Corporation is a leader in the development of disk security protection systems. Its products can make the duplication of copyrighted programs difficult, if not impossible.

Vault's *Prolok* has been used to protect many best-selling programs, and in an industry where revisions, updates, and improvements are the norm, it is no surprise that Vault has announced a new protection scheme called *Prolok Plus*.

The Best Defense

Not so predictable is the way that Vault has programmed *Prolok Plus* to work. Whereas most protection systems merely prevent the copying of software, *Prolok Plus* is downright hostile to someone who tries to use an illegal copy of a program. You might say Vault believes that the best defense is a strong offense.

According to Vault officials,



W. Krag Brotby

when you boot an illegal copy of a disk protected by *Prolok Plus* several things can occur—none of them desirable.

First, a message will appear on the screen warning of potential damage to data or hardware. Ignore this at your own peril, cautions Vault Corporation Chairman W. Krag Brotby, because if the machine has a hard disk, its entire contents are likely to be erased. *Prolok Plus* can also implant a "worm" in the system that will cause immediate or subsequent damage to the data or the operating system.

"Several manufacturers have become sick and tired of software pirates," says Brotby. "They haven't been able to deal with them legally. This system puts some of the onus on the illegal user."

Brotby maintains that there are no accidents, pooh-poohing the idea that a user can possess a

disk and not know that it is a pirated copy. If disks are properly labeled, he says, mistakes can't be made.

Doubts Abound

But some software publishers, even those who loudly denounce piracy, aren't sure that *Prolok Plus* is the way to go.

"The risk is too great," says David Rose, the developer of *ProKey* and director of product planning of *Rosesoft* in Seattle. "We think this kind of vindictiveness is a really bad idea. We would not use any copy-protection system that would run the risk of damaging data, software, or hardware owned by the end user."

"We know of a piece of software that will blow up people's monitors," says Don Huesman of *Conceptual Instruments* in Philadelphia. "We joke about that as a means of copy protection. But I'm against the idea of inflicting serious damage. A lot of people don't know what they're doing."

"We're personally not inclined to use the *Prolok Plus*," says one software developer who uses the unenhanced *Prolok* for his product. "It's a little too threatening. There are other means of copy protection, which is all we are interested in."

Brotby says he doesn't expect the program to be popular, adding that only about a dozen companies have signed on so far.

"It's an option," he says. "It can be employed if the manufacturer chooses to use it. We suggest that the manufacturer clear-

ly label the product so there isn't any doubt."

An Earlier Problem

Vault has just recovered from a recent controversy involving *Prolok*, which turned out to be an incompatibility problem with some early PC-I hardware. Vault has willingly exchanged the old program for the new, which, according to Brotby, contains just a "1-byte code change." Still, *Prolok* was accused of erasing the data it was designed to protect. *Ashton-Tate*, which owns a significant amount of Vault stock and uses *Prolok* on many of its programs, has not yet decided if the new system will be used on the next version of its popular *Frame-work*, according to an *Ashton-Tate* spokesperson.

"We would prefer not to have to copy-protect," says Huesman, whose software can be easily duplicated.

"There is serious opposition to each one of the copy protection schemes. It's a tense issue with strong feelings on both sides.

"We would like to make the effort to keep honest people honest. You can't beat the really determined pirates."

In the meantime, those "really determined pirates" would be well-advised not to walk away from their computers if they insist on booting an illegal copy of a disk protected by *Prolok Plus*.

Vault Corporation can be contacted at 2649 Townsgate Road #500, Westlake Village, CA 91361. Its telephone number is (800) 445-0193. ■

Upping the Ante With 256K Chips

BY TOM BADGETT

ESSEX JUNCTION, Vt.—In typical fashion, IBM—seldom first but always proper—has formally introduced a 256K-bit RAM chip, joining Intel, Texas Instruments, Motorola, Mostek, and several Japanese companies in the push to put

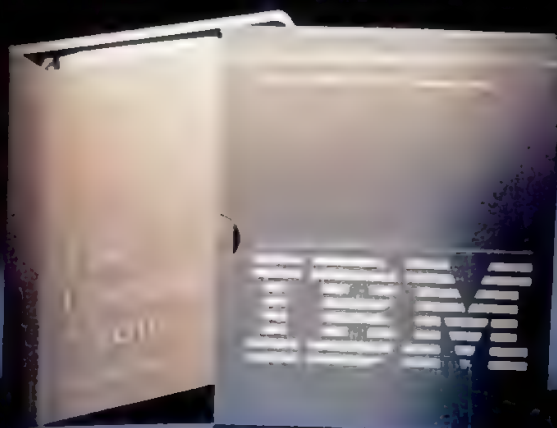
more money into less space. IBM has two immediate applications in mind: the 256K Memory Expansion Option for the IBM PC, PC-XT, and AT microcomputers, and a cache memory module for the compa-

(continued)

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WHY DEBUG YOUR PROGRAM IN ASSEMBLY LANGUAGE WHEN YOU WROTE IT IN ONE OF THESE...

ATRON Announces Source Level Software Debugging

Without source level debugging, the programmer must spend time mentally making translations between assembly language and the C, PASCAL, or FORTRAN source code in which the program was written. These tedious translations burn up valuable time which should be spent making critical product schedules. The low level hex and symbolic debuggers available today are superseded by ATRON'S solution — Source Probe.

HOW TO SINGLE STEP YOUR SOURCE CODE AND KEEP CRITICAL DATA IN VIEW

With Source Probe, you can step your program by source code statements. While stepping, a window which you define can display critical high level data structures in your program. The next several source code statements are also displayed to give you a preview of what the program will do

HOW TO DISPLAY DATA IN MEANINGFUL FORMATS

Why look at program data in hex when you defined it to be another data type in your program. Source Probe provides a formatted print statement to make the display of your variables look like something you would recognize. You can specify data symbolically too.

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Source Probe provides an on-line text editor to allow you to log program corrections as you find them while debugging. With on-line display and editing of source files, the time lost printing and looking through program listings can be eliminated.



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When Source Probe is running on ATRON'S PC PROBE hardware, the real time execution of the program is saved. You can then view your source code as it executed in real time — including all the changes the program made to your data variables.

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When running on PC PROBE, the Source Probe can trap a bug which overwrites a memory location. Because complex pointers are normally used in high level language programming, this bug occurs frequently and is very difficult to find.

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256K Chips (continued)

ny's System/38 minicomputer. Cache memory serves as a temporary storage area for data moving between main system memory and intelligent storage devices such as hard disk drives.

Other companies have been shipping 256K-bit chips for several months, however, and microcomputer and peripheral manufacturers are scooping them up. The Compaq DeskPro computer, announced last summer, comes standard with 256K bytes of on-board memory using 256K bit memory chips.

Apple is using a fair number of the new chips for its 512K-byte "Fat Mac" and to upgrade already-sold Macintoshes.

Prompt Acceptance

Memory expansion manufacturers are incorporating the new chips into current lines and most have new products in design or on the way. Many of the boards currently available from companies, like Tecmar for example, can be converted to the 256K-bit chips simply by replacing the 64K chips with the new ones and changing a jumper on the board.

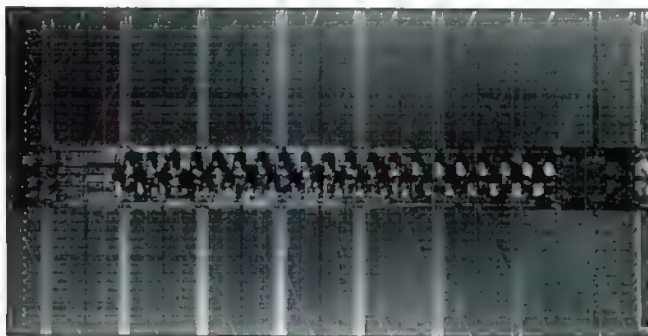
The recently announced Advantage! multifunction card for the IBM PC AT from AST Research is designed around the 256K chips. The first 128K-byte block of memory on the board uses 64K-bit technology, but the Advantage! can be expanded to 3 megabytes of memory with 256K chips.

"This 256K chip is the best thing that's ever happened to us," says AST's John Purner, Director of Product Marketing. "Now we can give an AT owner two serial ports, a parallel port, and 3 megs of memory and leave five expansion slots open."

Purner notes that the IBM PC-XT and PC Portable motherboards could be reconfigured for the 256K-bit chips "with very minor revisions—really minor."

Legacy Technologies, on the other hand, has decided the chips are still too expensive for serious consideration. Legacy engineer Steve Jacob says it'll be 6 months to a year before the

price of 256K-bit chips come down enough to make them competitive with current 64K chips. Prices are running between \$40 and \$50 per chip for small quantities. At manufacturer's quantities, the 256K chips are still seven or eight times more expensive than the \$1.85 64K chips. At four times the 64K cost, a manufacturer breaks even on a 256K chip



The internal architecture of a 256K chip.

upgrade and saves board space. Even at six times current cost, some manufacturers would consider the change to take advantage of the space savings and to keep up with the latest technology.

"I think in the next year we'll see most people move to the 256K chips," Jacob says, but he believes the current 64K chips will figure prominently in many designs for another 2 years or more. "There are a lot of companies working on megabit RAM chips. I'd say you'll see one-megabit chips before the 64K chips die."

From a user's perspective, there's little difference between the 256K and 64K chips. Performance characteristics are similar, and, as long as a board has been designed for the slight hardware differences, it should work the same way with either chip. Usually, a jumper change is all that's needed to make use of the new chips.

Comparisons

256K bytes of memory using eight 256K-bit chips takes up about half as much space as the same 256K bytes using 32 of the smaller 64K-bit chips. Engineers also say they can place these new chips closer together than the 64K versions. Access times on the 256K chips are

nearly identical to those of the 64Ks, and power consumption is about 40 percent less.

Interestingly, however, the published access times for IBM's chips are up to three times slower than those for Intel's version of the chip. With properly configured hardware, there should be no difference in software performance. But as the 256K integrated circuit

chips are more widely used, "standard" computer memory will likely get larger, and programs will make use of it.

"Programmers are a messy lot, so we'll use as much memory as you'll give us," AST's Purner observes, but, he says, software will become more sophisticated as a result of larger memory. The denser chips also will lead to multifunction cards with more features, such as a modem card with 3 megabytes of RAM and maybe a serial port. Purner looks for networking to become increasingly popular for lap computers with ample memory to be available soon, and for increasingly intelligent peripherals to reach the micro market.

"I think disk caching with some processing ability on external hard disks is an important thing," he says. "There's no reason at all that a 40-megabyte disk, say, couldn't back itself up to tape without interrupting the CPU."

Steve Jacob of Legacy agrees, but he thinks manufacturers may choose a 64K-by-4 chip architecture for smart peripherals rather than the currently-popular 256K-by-1. With a 256-bit chip arranged 1 bit wide, it takes eight chips for 8-bit storage (256K-by-8). A 64K-by-4 chip still holds 256 kilobits of infor-

mation, but it takes only two chips across for 8-bit storage of 64 kilobytes. IBM is manufacturing its 256K-bit chip as a 256K-by-1, 64K-by-4, or 32K-by-8 chip, depending on the application.

"I think we'll put a large amount of intelligence into subsystems and peripherals so you will be able to access disks almost as fast as RAMdisks," Jacob says.

Nearly all chip watchers agree that 256K chips should lead to expanded graphics capabilities on today's micros.

"We should see some really sophisticated graphics boards," says Tecmar engineer Johann George, "and programs which are fancier and easier to use, but they'll use a lot more memory."

Getting Smart

Intel believes the trend toward more memory at lower cost will push development of "smarter" software, and software that now runs only on larger machines will soon be available for micros. The company says the new technology also may "make computing resources more affordable and more available to a wider range of people."

While the new chips have been on the market only a few months, they apparently are easy to get. Apple spokesman Jim Damoulakis says dealers will get only a limited quantity of new Macintosh boards for a few months, but things should ease after that. AST and Tecmar say they're getting all the chips they need, and the chips are functioning well.

"We're finding that the 256K chips are as reliable as the 64K chips," John Purner says. "We buy chips literally by the millions, so we have a pretty good idea of how those chips ought to work."

Overall, the mood seems to be one of quiet acceptance. After all, the industry has made these kinds of transitions before, from the early days of 1K-bit memory chips. The new 256K chips are useful, even exciting to some designers, but newer technology is just around the corner, and this is just one more step in that direction. ■

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Blitz (continued from page 33) overwhelming incursion into the business software field.

Based On a Database

Data Edition is the heart of the Personal Decision Series. This program manages an integrated database for the entire series, which means that you only enter your data once and you can then access it from any of the other programs.

Data Edition (\$250) readily accesses data already computerized by other IBM software and systems, including programs using DOS and Data Interchange Format (DIF) files as well as such public database services as Dow Jones and The Source.

Plans Edition (\$150, due in December) works with data entered in *Data Edition* to create models and spreadsheets, complete with graphics and formatted reports.

For those with more advanced needs in modeling and specialized business planning, IBM also introduced *Plans + Edition* (\$300, due first quarter of 1985), which adds comprehensive financial, statistical, and transcendental functions to the basic *Plans* package.

Both *Plans* and *Plans +* use information entered in *Data Edition* and can access data on other systems and DIF files. All or part of the spreadsheets can be output to the other programs in the series, including *Reports + Edition* and *Graphs Edition*.

The \$150 *Reports + Edition*

report writer combines the record selection and computing abilities of *Data Edition* with the ability to design report layouts on the screen.

Graphs Edition (\$200) offers line, bar, surface, and pie graphs as well as scatter diagrams and text charts, with the ability to create multiple plots of the same graph and the ability to put up to four graphs on a page.

Words Edition (\$150) is a limited word processor geared to report and other short-document writing. It can use information from the files in *Data Edition* while writing and incorporate spreadsheets, reports, and graphs from the other programs during printing.

The series also includes *Mailing Label*, *Prospect Tracking*, *Client Time/Cost Accounting*, and *Asset Catalog* productivity extensions (\$60 each), as well as a \$70 *Appointments Calendar*.

Accountability

The Business Management Series is a series of stand-alone accounting packages. Data created under one application can be passed to another when appropriate, and the data file definitions connect the accounting packages with the programs of the Personal Decision Series.

IBM announced *General Ledger*, *Accounts Payable*, *Accounts Receivable*, *Payroll*, *Order Entry and Invoicing*, and *Inventory Accounting* applications (\$695 each). All the programs include built-in audit and control characteristics. The

programs are menu driven, sharing consistent data entry procedures. Coming in early 1985 are an *Accounting Extensions Edition* and a *Financial Extensions Edition*, both for \$245.

Training and Support

IBM also announced seven training packages, one for each of the accounting programs and another for the Personal Decision Series. The accounting training packages are \$95 each and the Personal Decision Series's *Data Training Edition* is \$70. In addition, extended support will be available to registered owners of the software. The 90-day free support policy can be enhanced with the purchase of an extended support subscription plan. Under the plan, extended support costs \$225 for the Business Management Series, \$125 for the Per-

sonal Decisions Series, and \$275 for both. IBM also offers a telephone assistance program at \$40 a call.

Industry observers point out that the design of the systems is reminiscent of programs written for mainframe and minicomputer applications. The code is written in assembler and Pascal, but the system is bulky, to say the least. For example, the *General Ledger* program takes up nine disks, making a hard disk a virtual necessity.

The compatibility of all the applications, however, coupled with the link to Systems 36 and 370, gives businesses the chance to create a fully integrated system for data management. That, combined with readily available training and extended support, will make IBM an even larger force in the business software field than it has been to date. ■

Competitors Respond

NEW YORK—IBM's continuing foray into the business software market was expected, but the competition has seemingly decided to watch its effects on the market before shifting into panic mode.

"We can't say much until we've seen the packages," says Burt Bralliar, director of strategic marketing for Peachtree in Atlanta. "It hasn't come as a surprise that IBM has gotten heavily into software, but no one will go out of business tomorrow."

Bralliar adds that IBM's *General Ledger* program's nine disks makes it less easy for microcomputer users to handle. In order for IBM's competition to be seriously affected, he says, the new programs "would have to solve, in a nifty way, the age-old problems of accounting software and have a high degree of functionality along with an easy-to-use interface."

If IBM has accomplished this, Bralliar admits, Peachtree "will need to scramble."

Lotus, developer of *Symphony* and *1-2-3*, is now "formulating a position" about the IBM software move, according to a spokesperson. The company has kept mum, even though "several reporters have been calling."

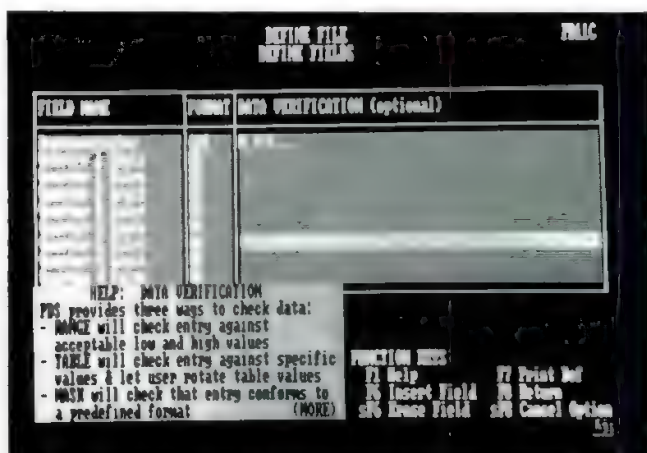
Eileen Adele of Decision Support Software in McLean, Virginia, said that the small company had just completed enhancements on its two accounting packages making them "more powerful, efficient and user-friendly" than what IBM has unveiled: "It's obviously competition," she says, "but we don't foresee any problems."

"It will have no effect on us," says Signe Ostby, director of marketing for PFS of Mountain View, California. "The products are geared toward a high-end user, in a higher price category. IBM is targeting a more feature-oriented user who will give up ease of use for a greater feature richness."

"It's too soon to tell if it will result in something as drastic as companies going out of business," she says. "Feature-rich programs, such as *WordStar* or *dBASE II* may be in jeopardy and their manufacturers may have to cut prices or increase their marketing effort."

"They've never had to compete directly with IBM before."

—Charles Bermant



Help screens are readily available while entering information in the *Data Edition*, the core of the Personal Decisions Series.

PCs Worked Both Sides In 1984 Election

PC meant "political computing" for both the Reagan and Mondale forces this year.

BY CHARLES BERMANT

WASHINGTON, D.C.—Microcomputers have played a large part in this year's presidential contest between Ronald Reagan and Walter Mondale; PCs and compatibles have been used on both sides for everything from delegate tracking to updating picnic guest lists. While mainframes remained vital campaign tools, 1984 will be remembered as the year PCs changed the face of elections.

The jump in PC use from the 1980 campaign, insiders say, reflected the growth of the overall PC market. And the use of computers in campaigns will continue to mirror the mushrooming use of micros, they predict.

Shortly before the election, Grayling Achiu and Bill Krause, of the Reagan and Mondale campaigns, respectively, discussed their use of personal computers.

"You can do more in a day now than you could do then in a week," said Krause of the 1980 campaign.

"In 1980 we did all the graphics by hand," Achiu said. "This year, we had a staff to synthesize all the information and make it easily digestible."

The most obvious computerized campaign function, polling, has long been impossible without computers, but the advent of PCs has significantly sped up the process.

Polls Apart

"We have access to polling data as soon as it comes out of the field," Achiu said. "Four years ago it would have taken much longer."

Achiu said that the Reagan campaign stored not only the poll results, but the raw data, something the Mondale forces did not do.

Although polling data is often

stored and analyzed on a mainframe, for scheduling, the campaigns used PCs almost exclusively this year. Achiu used a program that punched up a map of the United States, color-coded to represent visits from



Reagan, George Bush, both, or neither during a specific time period.

The Republicans kept similar track of state visits by Mondale and running mate Geraldine Ferraro. Democratic pollster Peter Hart tipped his hand during the summer when he said, "If you want to know our strategy, just look where we are going." Achiu interpreted this, with the aid of his PC, to mean that the Democrats were "writing off" most states west of the Mississippi.

The Democrats, on the other hand, did not follow the opposition's moves. As in 1980, they used a database program to track the schedules of candidates and surrogates to avoid sending both of them to the same place. Having Walter Mondale and Edward Kennedy in the same town would steal thunder from both. This scheduling, along with campaign budgeting, was accomplished on Compaqs.

The PC of choice for the Reagan camp was the Corona,

selected, according to Achiu, because "they gave us the best deal." In addition, Reagan's campaign used a few "maxxed out" IBM PC-XTs, one of which ran without a cover because it constantly overheated.

Achiu said he sought to "get the most out of his computers for the least money." He added that the campaign brass "has been more than generous in meeting our computer needs."

Two PC System

While describing the Reagan campaign's use of PCs, Achiu's speech is littered with words like "efficient" and "productive." The Democrats have a



natural base of 52 percent of the population, he said, so Republicans must always work extra hard to break even.

The use of PCs has also increased the speed of the campaign. By maintaining a database of opponents' positions, a candidate can increase response time. "If you don't bounce back quickly," says Louisa Dixon, who worked on Senator John Glenn's abortive campaign, "another candidate can get away with a misstatement."

Dixon never got to use her delegate-tracking program, which would have contained personal details about each convention delegate. "If the campaign had continued," she says, "this information would have been critical." And although Mondale was assured of the nomination, he used a similar program to keep his fingers on the pulse of the convention voters.

Ronald Reagan, unopposed in his own party, had no need to track convention delegates. Achiu's own PINS program,

however, used a database manager to break down information about each state, with the most recent poll figures, past vote totals, and the names of party leaders keyed in. Each state was allotted a certain amount of points based on its importance and the chances of a Republican victory. Visits by Reagan, Bush, or party leaders were assigned different point values and were subtracted from the totals.

Krause said he didn't think the Republicans had the high-tech advantage. Although, he said, "people perceive an imbalance in fund raising and money, there is not as big a gap as they think. The lower cost of micros has made it possible for even poor Democrats to use the new technology. We're not any less intelligent."

Byte-Filled Rooms

Achiu, who has been fascinated with politics all his life and holds a political science degree, has always wanted to be a stereotypical, cigar-chomping "back room" politician. In the future, he says, such pols will have political experience, keen intuition, and an understanding of technology.

"Politicians of the future may not know how to write a command file, but they'll know what the data means," he says. "Computers force people to be honest; it shows data that needs to be addressed."

Achiu feels that increased PC use will not eliminate traditional campaign volunteer chores such as envelope stuffing and letter writing, only increase the efficiency of the process.

Jeff Carter, son of the former president and himself a programmer, says that there are only two campaign functions that PCs cannot do: because of memory limitations, they cannot maintain national mailing lists or prepare required Federal Election Commission reports.

Some, like Louisa Dixon, are less certain about PC's political future.

"The hardware has changed since I started," she says. "Who knows what the next group of computer wizards will come up with?"

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To run ProKey, you'll need an IBM PC, XT or jr., or a compatible, and DOS (any version including 2.1). dBase II is a trademark of Ashton-Tate. Corporate and OEM licenses available.

BOOK REVIEW

3-D PC Book Lends Depth to Learning

BY CHARLES BERMANT

Inside the Personal Computer

Sharon Gallagher
Abbeville Press
505 Park Ave.
New York, NY 10022
(212) 888-1969
Copyright: 1984
Cover Price: \$19.95
ISBN: 0-89659-504-8

Pop-up books, fondly remembered from childhood, were the original multimedia messengers, lending a true "hands-on" dimension to childhood literary exploits. While their limitations were obvious, they were instrumental in getting some of us through our initial reading efforts.

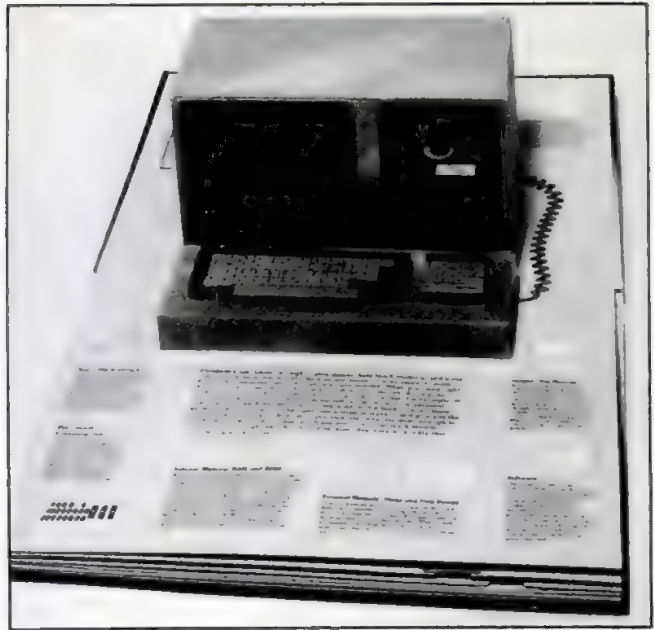
Some of the same memories, it seems, are shared by those behind Abbeville Press's new *Inside the Personal Computer* pop-up book. The 12-page guide is far pithier than one might expect. It is a mini-direct-

tory of the most common computer terms and serves as a valuable introduction and reference tool for children.

The thrill for kids is obvious. The book's movable keyboard, disk drive, and printer could keep a child busy for hours, and the disk drive in particular gives good practice for handling the real thing. If kids don't feel like reading through all the gobbledegook, there's still enough to keep them amused.

Adults will also have a hard time keeping their hands off the clever cutouts. The book is a downright user-cuddly introduction to computers. Its pale-blue tones are easy on the eye, and the easy, crisp definitions neither boggle the mind with complexity nor insult readers with cute oversimplification.

The pop-up structures include a movable keyboard that translates "M" into its binary



equivalent, a motherboard with an installable add-on chip, and a chattering dot matrix machine that "prints" its own "goodbye." The scanning electron beam of a CRT is clearly demonstrated by a moving white string. Other flaps and wheels display such things as the contents of a disk or the conversion of a keystroke into its binary bits.

Even hard-boiled computer cynics will find this book

charming, but it is perhaps best-suited for the novice user who hates wading through manuals.

The \$19.95 cost may be too dear; a computer dictionary from a bookstore's overstock is a better investment. But it won't be nearly as much fun, and this volume may have the honor of being the computer age's first coffee table book.

And that distinction can't come cheap. ■

Calendar of Events

DATE	EVENT	COMMENT	LOCATION	CONTACT
November 11-14	The Information Nation: New Actors, New Factors	Presentations on technology information and trade trends.	The Sheraton Palace San Francisco, CA	Information Industry Association 316 Pennsylvania Ave., SE Washington, DC 20003 (202) 544-1969
November 14-18	COMDEX	Hardware, software, and accessories.	Las Vegas Convention Center Las Vegas, NV	The Interface Group 300 First Ave. Needham, MA 02194 (800) 325-3330 (617) 449-6600
December 4-6	Microcomputer Database Management	Seminars on how to select and use a micro-DBMS.	Dupont Plaza Washington, DC	Software Institute of America 8 Windsor Ave. Andover, MA 01810 (617) 470-3880
December 6-8	Great Southern Business & Computer Shows & Seminars	Hardware, software, and accessories.	Leon County Civic Center Tallahassee, FL	Great Southern Computer Shows P.O. Box 655 Jacksonville, FL 32201 (904) 356-1044

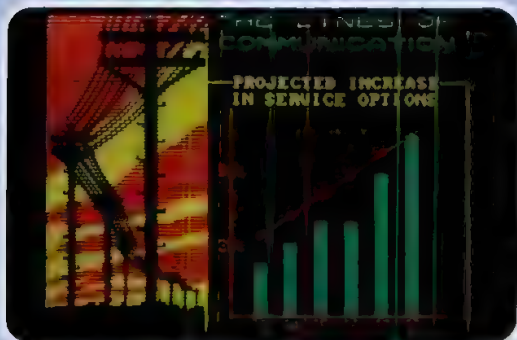
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—PC Magazine

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Albert Litewka

The president of Warner's software division is a (desk) organization man.

BY CHARLES BERMANT

NEW YORK—Every time Albert Litewka walks past all the bags full of mail from people who have ordered a \$2 *Desk Organizer* demonstration disk, he breaks into a wide smile. And every time, the mail clerk makes it clear that the situation isn't funny.

As president of Warner Communications's new software division, Litewka is spearheading the mass-marketing of *Desk Organizer*, its first product. The sales techniques themselves aren't new, nor is the product quite as special as its promoters maintain. But the combination of the two may set precedents for the way software is marketed in the future.

"I see this as a whole new world of publishing," Litewka explains. "There are elements of software publishing that are analogous to books, but others are wholly unique."

"It is a major new opportunity field. Most traditional book publishers have at least looked at the idea of software publishing. They feel that if they don't get in there someone else will."

To promote the *Desk Organizer*, Warner designed a catchy logo, turned out two different marketing kits, engineered a massive advertising campaign (including the one offering the sample disk), sent a letter and sample disk to those on technically oriented mailing lists, advertised on radio, and "looked at" advertising on TV.

Distinctions

The *Desk Organizer*, developed and previously released by Conceptual Instruments Company in Philadelphia, files, categorizes, reminds, recalls, and writes. It is designed to tie up all the loose ends in a business day and can be concurrently run with other programs.



"For our entry into that market, we wanted a breakthrough product, one that created a new category," explains Litewka. "We looked at hundreds of programs. But when we came across the *Desk Organizer*, we felt it was that breakthrough product. It was different by definition. It wasn't a spreadsheet or a word processing program. We think it is the beginning of what is the next important front."

Litewka adds that many PC programs are oriented to the strengths of the computer, not the job needs of people. This program fits people's needs, he says, and conforms to the way people work rather than the other way around.

This process doesn't seem all that far from "Where's the Beef?"; as if Warner were aiming for a high-visibility ad campaign that places a familiar phrase on the tip of everyone's tongue. In reality, that type of software sell is at least a few years away—when hardware is as common as hamburgers.

And when it happens, you get the feeling that Warner—and Litewka—will be right there.

"We want people to understand our product," he says. "We want anyone to be able to walk in, pick it up, and understand what it does. Some products are hurting themselves because they offer little or no clue to what they're about. But we are here to answer any ques-

tions that may arise. We are totally committed."

I've Got A Secret

Warner, of course, is a renowned movie and record company. But while it will eagerly volunteer how many people are going to see the new Clint Eastwood movie or buy the new Prince album, they are considerably less forthcoming about the money spent in and earned by the software division.

Litewka declined to reveal sales figures, the number of *Desk Organizers* being manufactured, how many people are working on its promotion, or any other question that alluded to the bottom line. He will only say that \$2 million has been committed to the product's promotion for the first year.

Moreover, software's mutable nature makes its marketing different from books or records.

"With a book or a record, you just put it out and that's it," Litewka says. "When you write a novel, you don't worry if people will still be reading English in six months. With software, the technology is changing. What's in that box today may not be what's in it a year from today. We are planning an evolution of the product."

"We're now at a stage where we have taken a highly technical product and modified it in a user-oriented way."

Talent Search

When the software division was founded 18 months ago, Litewka targeted the business/professional category. That market was thought to be strongest because of its size and stability. It was more firmly rooted in need; even if people "need" to be entertained, it's the business programs that post big profits.

"It's not like a book," says Litewka. "But you do have to

recognize talents and how they work. You need to guide them and critique them in a way that builds them up."

"In the end, if I think a feature isn't right, it isn't right. If it seems like gobbledygook to me, it will also seem that way to other people."

There is no saying when Warner will release their next program. Litewka claims that the next candidate has yet to be chosen. Another stark difference between software and records, books, or movies is volume; the software division might be in existence three years before its second program is produced.

But like other fine arts, Litewka is taking his talent search far and wide. This isn't Silicon Pan Alley where the hits are written in-house.

"Our philosophy is to find that which is unique," he says. "If you wanted to publish a brilliant novel, you couldn't just commission it to someone in your office and expect to come up with Norman Mailer."

All of Warner's effort is centered on getting *Desk Organizer* off the ground, but Litewka is keeping options open, looking for the next software superstar. He claims openmindedness, saying he doesn't know where the next brilliant product is going to come from. It may be from someone who has a nice letterhead and a brilliant presentation or someone who looks like he spent the summer in Central Park.

He says he answers every letter and phone call, but asks that programmers write letters with succinct, articulate descriptions of their program and what it does. He doesn't want any teasers, and the program should be useful and unique. Write him directly at Warner Software, 666 Fifth Avenue, New York, NY 10103.



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by _____
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business person, looking for an escape from bookkeep-
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the modules I needed: _____ [Ledger Sales Payables
Receivables, all of them]

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need _____ [two disk drives, a consultant to set it
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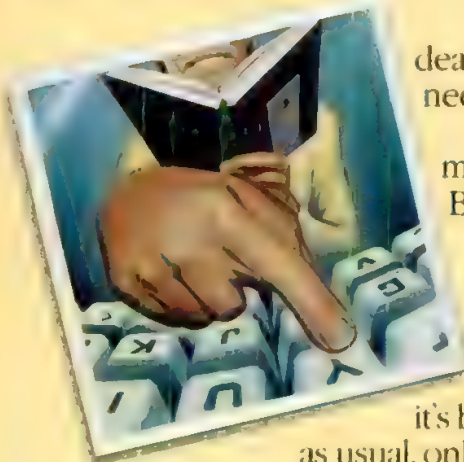
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it's business
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drum up more sales, relax]

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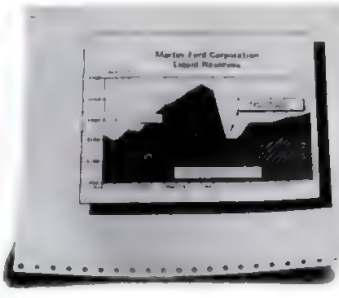


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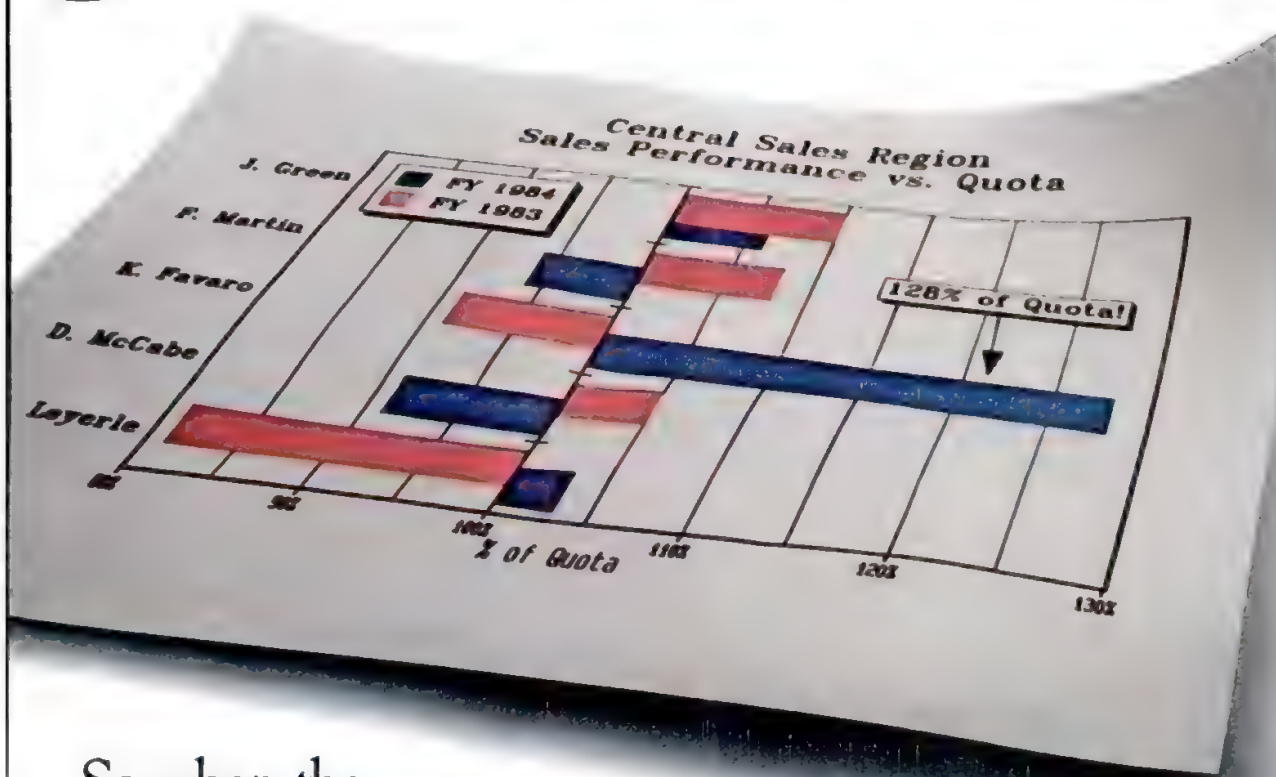
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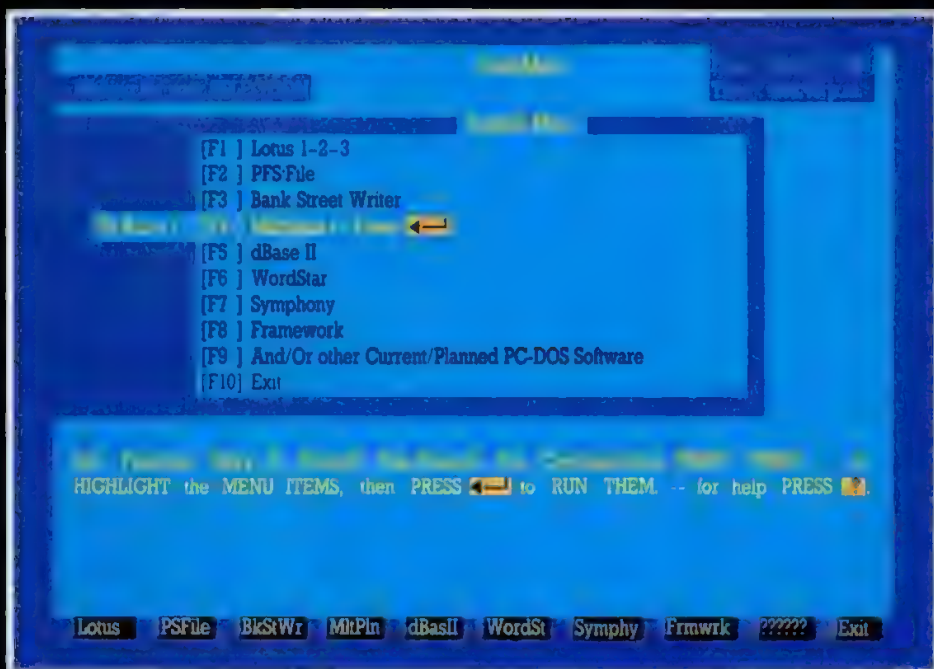
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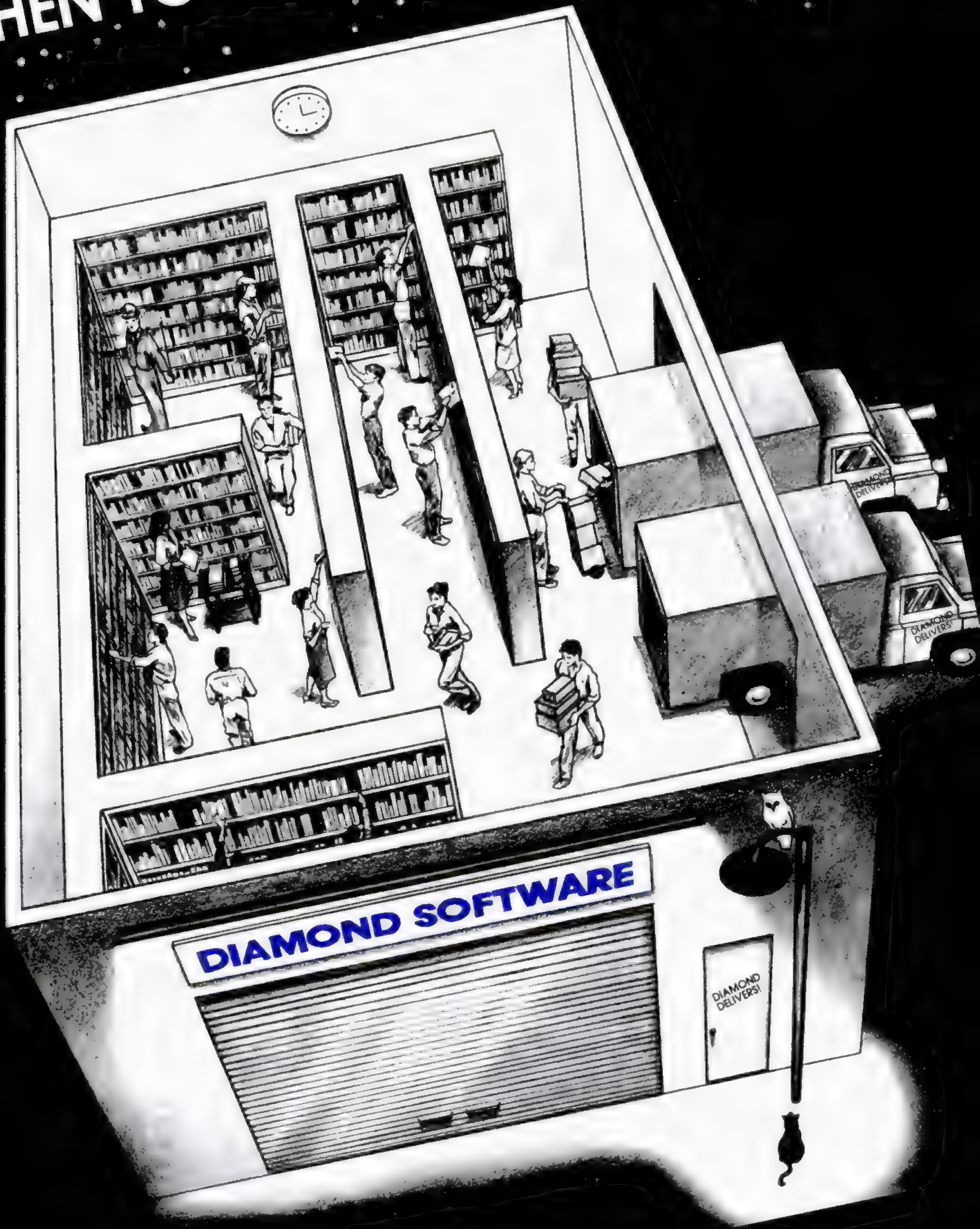
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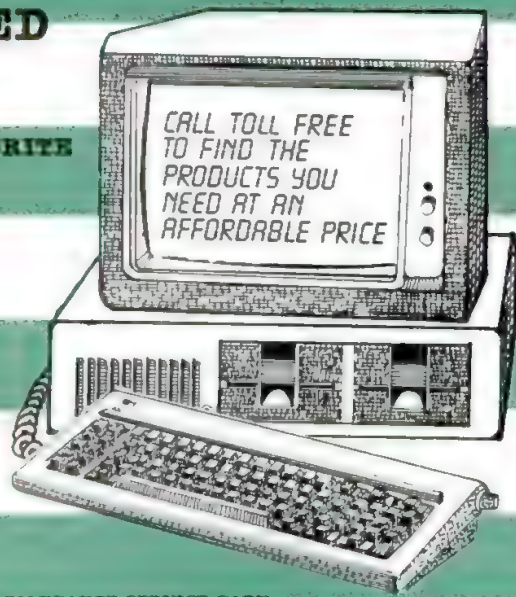
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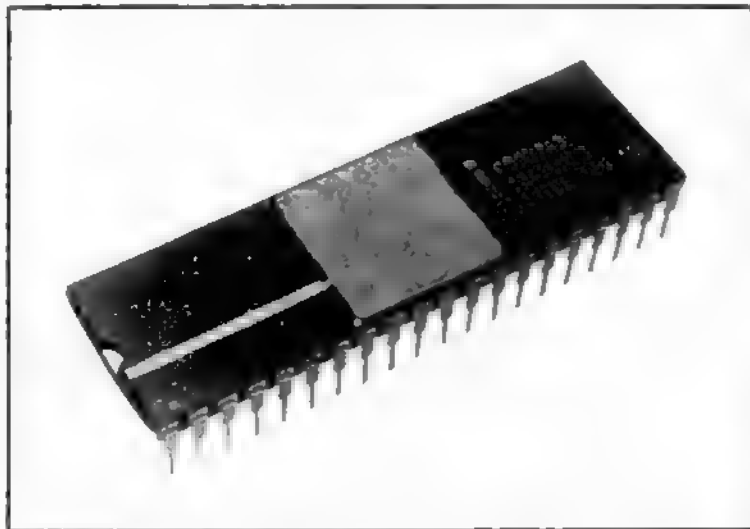
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We occasionally even break our arms patting ourselves on the back for the fine job we're doing. The adversities we encounter make fine grist for "What's Inside," and each retelling embellishes the anecdotes from our adventures.

This issue devoted to printers is our most ambitious yet. The printer is typically the second-most expensive item in a computer configuration. It can even cost more than the computer. Its output can affect the way others judge your work. It will likely be the most troublesome component in your system. With so much editorial fodder, you may wonder why no one before has undertaken a comprehensive review of printers. Here's why.

Why They Don't

Because it's difficult. It takes mind-boggling logistics combined with gut-

busting manual labor just to get the printers delivered, set up, and working. We started out with a potential universe of more than 240 products and pruned that number down to 120.



Bill Machrone

Because it's complicated. How many printers does your dealer carry? Is anyone at the store conversant enough with them to discuss all their features? If they're not, don't blame them. With a few rare exceptions, printer documentation stinks. You'd think the manufacturers had never hooked their machines to a computer. Salespeople get precious little opportunity to try out a printer's many capabilities.

Because it's expensive. Although we didn't have to buy the printers we tested,

it took months of planning, testing, and photographing to bring you this report. Twenty authors devoted most of August to these discoveries. We delayed the move of an entire Ziff-Davis editorial department into its new home so that we could have testing space adjacent to PC's office. We rented a roomful of IBM PCs to drive the printers and set up a sophisticated sound-level measuring station in our Toy Shop. We hired labor and expertise. We bought cables, special paper, extension cords, tables, and pizza.

Because it makes people angry. Only programming languages make people more unreasonable than printers do. The printer market abounds with legends, some substantiated, some not. These legends die hard. When you show people that the printer they swear by is an unmitigated turkey and expensive to boot, they don't thank you; they hate you. Further, since PC's testing leads us to come to conclusions, make comparisons, and pick winners, for every friend we make, we lose another. So it goes.

Because you need a good reason. Would you go through this much work if you were selecting a printer for your own use? Obviously not. What if you were a dealer trying to select products worth selling? Unlikely. What if you were the purchasing manager of a large company, trying to set some standards for internal

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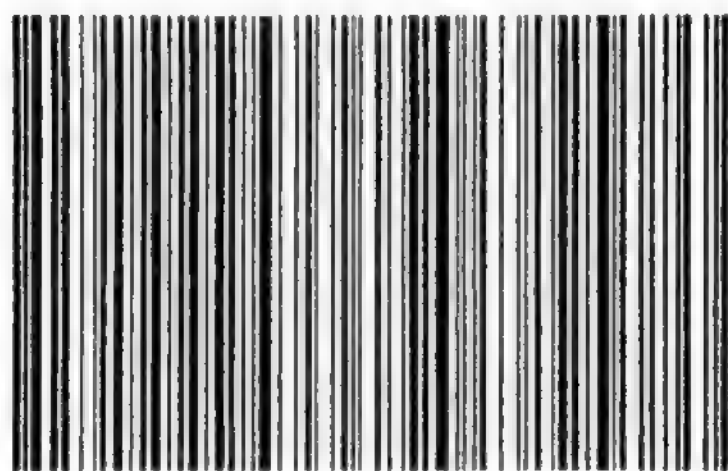
Gbs5lipBack-0018



Inverted Back

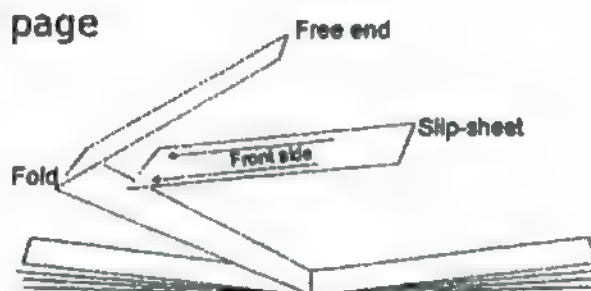
1. Follow instructions on the other side

Folded edge of the page

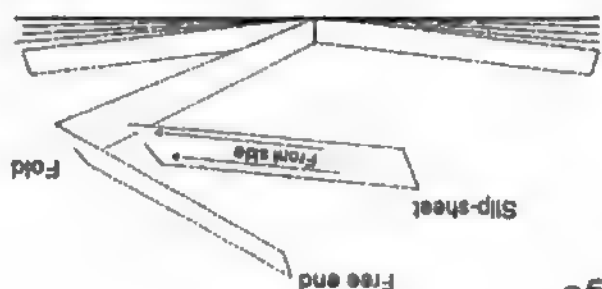


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1. Open the foldout page
2. Insert this sheet with
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 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

Well ho, ho, ho.

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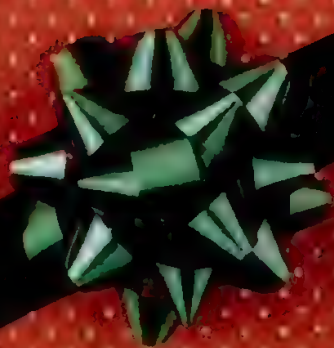
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Era 42 (1200 int baud)	\$395
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w/ Quadlink SW.....	\$529
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to 4 times faster).....	Call
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Optech CRT filters....	Call
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PC Documate (com-	
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EDITOR'S SCREEN

use? Maybe. What if you were the editor of a computer magazine? It depends on whom you are trying to serve. Today's readers? Tomorrow's readers? Advertis-

ers? Special interest groups?

As I've pointed out, there are lots of reasons why a magazine shouldn't want to do big hands-on comparison tests and

few reasons why it should. The decision is a bit like a television network deciding to send correspondents into a war zone. Some do it for the glory, some do it for the ratings, and some do it because they have to—everyone else is too. Some do it because they don't like the way others are doing it.

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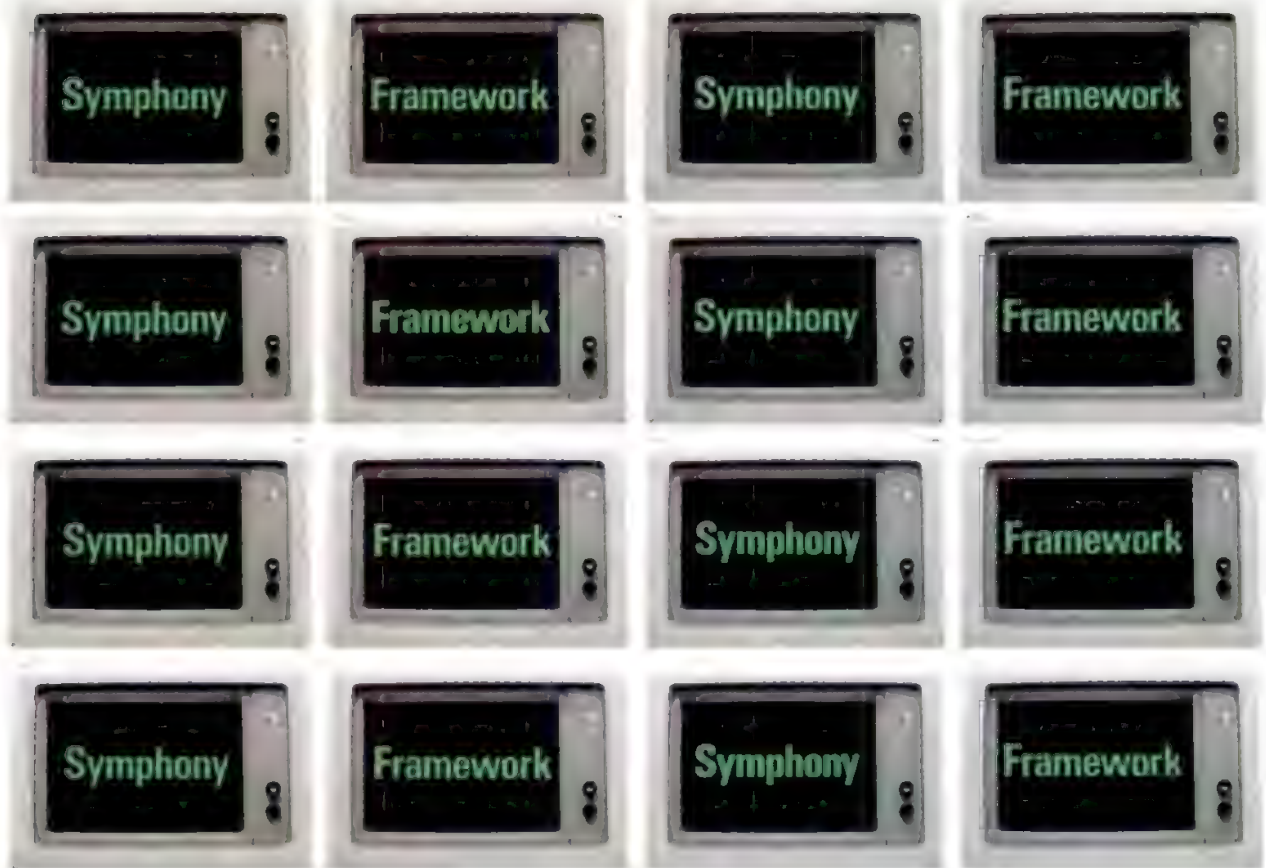
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Why We Do

We do it for expertise—you can call it glory if you like. We seek to make original contributions to the body of knowledge in the computer field. It's the primary way in which we can be useful to you. When associate editor Stephanie Stallings asked what I expected from "Project: Database," I told her that she would become one of the ranking experts on database management for the IBM PC. John Dickinson, the project manager for this issue, started with considerable expertise about printers. Now that he's been to the mountain, he has a view of printers shared by only a few others. Steve Kanzler and Robin Webster are also gaining expertise by managing the latest round of local-area network tests in our new labs in Belmont, California. In analyzing the performance of existing products, they're reaching conclusions about exactly what a network should and should not do. Their results will be in PC's January 22, 1985, issue.

When I was a kid, I used to read *Scientific American* as much for the advertisements as for the articles. Eastman Kodak's organic chemicals division published one series that I particularly remember. It would describe a compound or two and usually include some anecdotes about the chemists responsible for the product and odd things they were doing with it. The ad usually was enlivened by a diagram of some molecules. It always closed with the phrase "We'd like to be useful, even interesting."

That phrase bespoke a quiet expertise, competence, confidence, and good humor. I guess it could serve as PC's motto, too. ■



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CIRCLE 145 ON READER SERVICE CARD

A BUREAUCRAT'S GUIDE TO WORD PROCESSING

Now, if it were you or I and we wanted a word processing program for our IBM-type PC, we'd probably stop off at our local computer store and simply diddle with a few.

You and I, however, are not the U.S. Department of Agriculture.

(Nor any of its permutations of subsystems like the Economic Research Service, National Resources Economics Division, Data Services Center, etc., etc.)

So when the USDA told ERS to tell NRED and DSC to look into a truckload of w.p. programs for all their PCs, the last thing they wanted was simple diddling. Their dedicated Wangs and Lexitrons were far too few to handle their

needs, their IBM® PCs weren't compatible with them anyway, and nobody really, quantifiably, knew from word processing with a personal computer.

Definitely not a diddling-mode condition.

As they put it in The Exchange, an internally distributed publication of the Department of Agriculture: "A needs assessment showed that, in the long-term, a word processing system is needed that can increase word processing capability and also be compatible with ERS' Long Range Information Management goals."

Well, "Needs assessment" led swiftly to "procurement action," which galloped into an "objective review" of the eight top-rated PC programs on the market (as compiled by The Ratings Book published by Software Digest), along with Wordstar® and Display Write 2, because they had some around.

Thus armed with the names, the final evaluators (a team of secretaries from NRED who would be the primary users of the PC software) became armed with each of the programs, along with checklists to record such things as ease of use, advanced features, and similarity to their existing dedicated equipment.

The first to be eliminated from the prospect list were Office Writer™

and Samna™, since they're copy-protected and couldn't be transferred to hard disks.

Next, IBM's Display Write 2: because it's "not compatible with other software used in ERS (like Lotus 1-2-3,™ dBASE II,® etc.)," and it's "full of confusing menu options and cryptic error messages." Au revoir IBM.

Then, three more, for a variety of reasons.

Which left the following:

Volkswriter® Deluxe™

MultiMate™

Leading Edge™

Volkswriter Deluxe? "Too complicated and confusing." Not "easy to learn or use."

MultiMate? Not bad. It actually tied the winner in a few categories.

The winner being the one that won 82% of the votes in the Ease of Use/Ease of Learning categories. The one about which they said, "The ability to store deleted text and automatic document backup features were both highly desirable." The one they thought they'd quickly "be able to use . . . for their day-to-day word processing tasks."

The whole process took some three months of work by people in DSC to support the NRED in its work with the ERS and DSC to make the world a better place for the USDA.

But the results were well worth the wait. Because at last they've solved their word-processing problems . . .

"With Leading Edge!"  LEADING EDGE™

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CIRCLE 280 ON READER SERVICE CARD

Printer Standards Are Sorely Needed

The time has come for printer manufacturers to define new standards. The lack of common command sequences means that users can't take advantage of their printers' fancy features.

This issue of *PC* should convince you, if you didn't already know, that an enormous number of printers work with the IBM PC. The wide range of features, options, and prices allows you to tailor your printer to fit neatly between your needs and your pocketbook.

Unfortunately, that same variety can give you more sleepless nights than any other PC peripheral, because the industry has no generally accepted standards for how printers ought to work.

Most other optional gadgets for PCs follow well-established industry standards. If incompatibilities do exist, the vendor usually supplies a hardware attachment or program to run the device.

Printers are a different story. Most of them are easy to hook up to a PC and function well enough to print the alphanumeric portion of the standard 96-character ASCII set. But the PC has an expanded character set that includes 256 characters, some of which help produce graphics. If you use these extra characters with an incompatible printer, you can get some bizarre output.

Command Sequences

That's not even the worst news. Output options such as print enhancement, type pitch, and line height changes are driven by special character sequences

called "command sequences," "escape sequences," or just plain "control codes." But on any two printers, the same option may require different command sequences; this difference is where



John Dickinson

the heart of printer frustration lies.

Nonstandard command sequences mean few software products can support features for all printers that work with their users' PCs. Software authors must develop individual printer drivers for each supported printer or devise an elaborate mechanism for generalized printer support. Neither solution is satisfactory, and both are expensive.

As a consequence, users buy more expensive software that either supports a limited number of printers or requires

them to dig through often-inscrutable manuals to find out what command sequences will make the software work with their printers—if it can be made to work at all. In the end, many users never get to use the fancy features for which they bought their printers.

Standards

The American National Standards Institute (ANSI) has created a standard for printers and their features, but it is generally regarded as cumbersome, difficult to implement, and hard to use. That view may be justified, but there is no reason the printer industry cannot develop a better standard on its own, or just follow one already widely in use.

More and more manufacturers, in fact, seem to be taking the latter course. Of the printers tested for this issue, the ones that use the ANSI standard could be counted on one hand. But an increasing number of fully formed character printers follow Diablo's All Purpose Interface standard, and an equally impressive number of matrix printers (including Diablo's) follow Epson's design for command sequences.

Perhaps there's hope; in any case, a solution can't come too soon. Today's programs offer easy-to-use "what-you-see-is-what-you-get" screens, but they're not too helpful if you can't get what you see on your printer. ■

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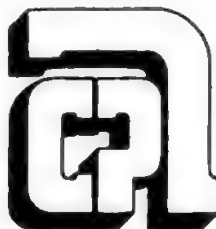
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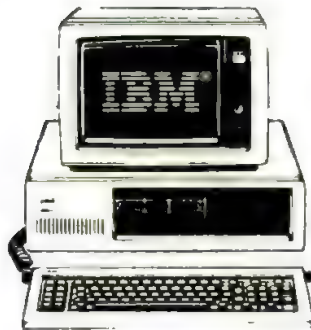
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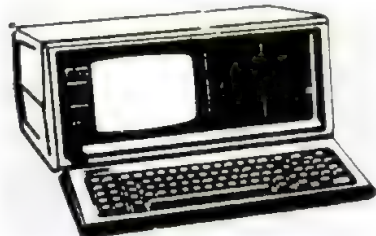
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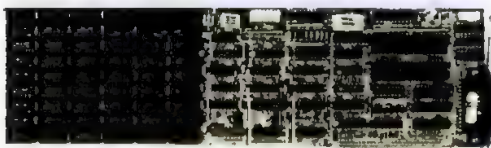
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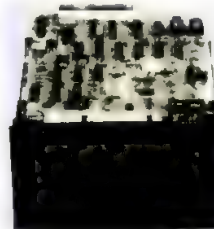


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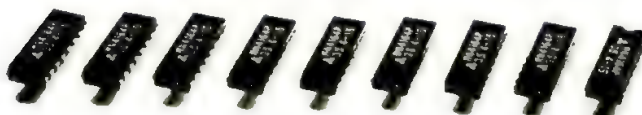
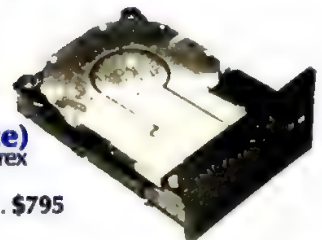


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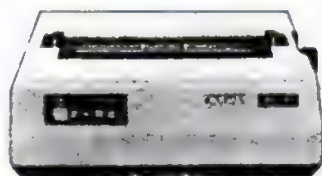
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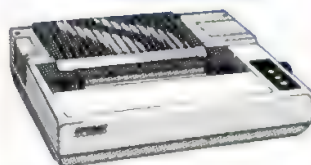
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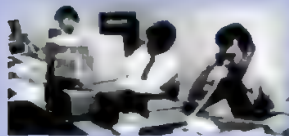
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CIRCLE 224 ON READER SERVICE CARD

Letters to PC

KnowledgeMan's Tune

I'd like to compliment *PC* on the quality of Project: Database (*PC*, Volume 3 Numbers 11-17). I found it most informative and helpful.

However, I would like to point out some errors in Richard Aarons's review of *KnowledgeMan*, the integrated database management system from Micro Data Base Systems, Inc. ("KnowledgeMan: The Professional's Tool," *PC*, Volume 3 Number 17, page 269). The chart on page 229 correctly lists the price of the program as \$500 but incorrectly lists the cost of the optional integrated modules, *KGraph* and *KText*. In fact, the list price of *KGraph* is \$225, and *KText* is \$175.

Also, the chart entry under "Time to Execute Standard Task" on page 243 is puzzling. *KnowledgeMan*'s time is substantially lower than the other packages listed in the chart. From our internal benchmarks against other similar database programs, we have found that *KnowledgeMan* is as fast, if not faster, than its competitors at normal data-handling tasks. Without knowing what your standard task was or how it was set up, I can't comment on the accuracy of your comparative data. However, it does give a misleading impression about the speed of *KnowledgeMan* relative to the other packages in the chart. I would like an explanation of how the task was set up and how the comparison was made.

Scott D. Palmer
Micro Data Base Systems, Inc.
Lafayette, Indiana

Richard Aarons replies:

Palmer's comments on prices are, of course, correct. How we evaluated task times requires an explanation of our standard task.

We began with a three-file employee database, which included 500 employee records, over 600 salary records, and 600 department records. Where multiple



salary or department records existed, it was assumed the employee had been moved from department to department, received salary adjustments, or both.

The first task was to update the salary records to provide a salary history and to update the department records to show the employee's current department. With KMan, writing the routine to do this took 5 minutes and the run took less than 9 minutes to complete. This is the time that should have been printed in the "Time to Execute Standard Task" block.

Project: Database Complaints

Your protracted reviews of database programs for the *PC* is probably the record holder for contributions having form without substance ("Project: Database," *PC*, Volumes 11-17). As such, it is just a major example of what the potential buyer of programs is faced with at any juncture when he or she believes that an intelligent choice of software can be made based on what passes as a review in the average magazine.

It has been my experience that a software package of any real content cannot be reviewed on a basis satisfactory to a commercial magazine for a variety of

reasons. Probably, the most important is that of timeliness. For reviews to be relevant, they should be timely, but for reviews to be thorough, they require a protracted period of use. A product that may appear to be good and useful at first glance may prove to be just the opposite upon further investigation.

Your reviews of databases suffered from serious problems. You cannot assess a database performance on the basis of a 50- or even a 500-record database. A database that accesses a record rapidly when using a 50- or 500-record structure may be excruciatingly slow when accessing a database of substantial size.

The time required to perform practically any of the important things you do with a database depends on record size. If you want to select records from a database using some criteria, the process takes two steps: the program must look at each record in the database (the amount of time this takes will be dependent upon the number of records); then it must apply the stated criteria to each record (the time that this takes will depend on the number of and kind of criteria and not on the number of records). Variances in time do not readily appear when doing things with a 50-record database.

Another problem that was not addressed in your reviews was the speed with which keys are accessed. This is an important consideration because practically everything you do with a database depends on this. Key access can depend on the nature of the key and the size of the database, and there is also the problem of the file size holding the key data. Most software boasts of the number of keys it has, so this feature should have been covered more thoroughly in your reviews.

Morton F. Kaplon
Pomona, New York

LETTERS TO PC

Dependable Digital Cassettes

Bill Machrone's article "Compaq Is Desktop Hit," in PC News, impressed me as a very good review of the latest offering from Compaq (*PC*, Volume 3 Number 15, page 35). However, I did feel that one of his "off-the-cuff" statements was extremely biased. He writes that Compaq "uses the 3M mini-data cartridge format, a great deal smaller than the standard data cartridge, and more reliable than digital cassette-based backup systems."

The current state-of-the-art technology that is being used to produce digital-quality cassettes and cassette tape drives results in systems that equal (if not surpass) the reliability of cartridge systems.

My company, MEMTEC, is a developer and manufacturer of miniature reel-to-reel tape drive systems for memory backup and storage. Our cassette drive contains only three moving parts: two motors and an optical encoder. Electronic control of the tape transport system provides low and constant tape tension, which results in long tape and head life. This way, you are always assured of a reliable backup system.

Patrick Dodds
MEMTEC Corporation
Salem, New Hampshire

Customers Test for Bugs

I agreed with Barbara Krasnoff's editorial "Consumer Guinea Pigs" (*PC*, Volume 3 Number 17) wholeheartedly, and I felt that I had to commend her and also make an additional comment of my own on the subject.

I feel that the attitude of many software publishers toward their customers is outrageous. When I first bought my computer, I was shocked that certain software publishers were releasing updates of their products because of bugs that needed to be corrected. Then it dawned on me—these companies were using their customers to test the products! I wondered what happened to the people who had bought an older release

of the program. Were they unfortunately stuck with a product that might not operate properly?

Because of this problem, I've decided upon a new policy. I refuse to buy a new program, no matter how good or how useful it might be, before the second or third version is released, or until it is at least 4 months old. I also hesitate to buy a software program from a new or unheard-of company.

I realize that I may be missing out on some very good software. I also realize that there are new companies that do test their software extensively before releasing it. But, with the price of software being so high, I cannot afford to take a chance on a new product.

Lorraine Benedetto
North Arlington, New Jersey

CREATIVE
WRITERS



Making Life More Difficult

Your article "Creative Formats for Creative Writers" (*PC*, Volume 3 Number 18) was an insult. The premise was to define a program that makes life simpler for the writer, yet the entire article detailed how the program made life more complex. The program is Pascal, creating extra procedures for telecommunications, and reading and writing to standard DOS ASCII files. Right there the program becomes obtrusive for any writer who must set type or telecommunicate from text files.

Though stating authors and writers need more than letter and report generation, the article is full of format and print drivers relating totally to letters and reports! The author gushes over the fact that the program uses the function keys.

The last paragraph of the article states, "The only important qualification for a word processor is that it does not get in the way" The article has at least ten references to obtrusive functions that complicate writing, not make it easier. Someone should give the author a copy of *Volkswriter Deluxe* so he can have virtual filing, on-screen formatting, automatic print drivers, and a program that is easy to learn.

Terry Ulick
Chicago, Illinois

Clear and Succinct

I have just finished reading Jared Taylor's review of *Expert-Ease* for the second time ("Putting a Ph.D. in Your PC," *PC*, Volume 3 Number 3). I read it for the first time when the issue came out, and upon rereading it I have decided that it is one of the most interesting articles I've ever read, as well as one of the clearest, most succinct considerations of the basic issues in the general area of expert systems that I've run across.

Joel Wallman
New York, New York

Sit Up and Notice Ada

I was somewhat baffled by the editor's comments following my letter that appeared in "Letters to PC" ("A Place for Ada," *PC*, Volume 3 Number 12, pages 97-98). I can only assume that I did not properly convey my thoughts regarding the future of Ada.

I don't expect that Ada will supplant COBOL in the near future as the dominant commercial language in the private sector. The massive investment in existing software and trained personnel will ensure that COBOL will continue to live for some time. You may have noticed, however, that most of the large COBOL shops are moving toward the new "fourth generation" languages as a means of combating the ever-growing applications backlog.

There is no argument that COBOL is time consuming and costly to write and

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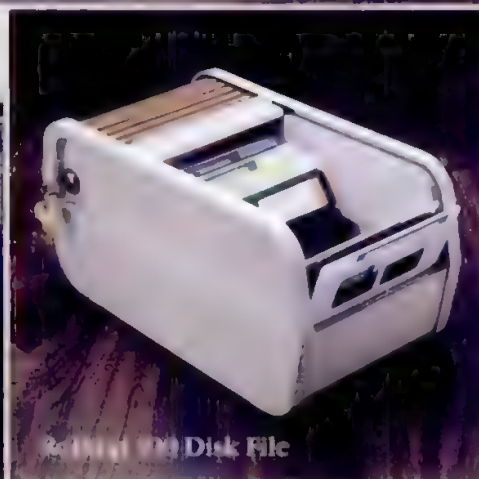
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LETTERS TO PC

maintain. There is also no argument that COBOL is not as portable as it was intended to be when the military, manufacturers, and major users first wrote its specifications. Machine-dependent functions of file management, screen-handling, and operating system services can differ vastly from system to system. This is exactly what the Department of Defense is attempting to overcome through Ada.

The initial use for Ada will probably be in the area of applications such as data acquisition, signal processing, and a wide variety of C3I (command, communications, control, intelligence) requirements. However, a large percentage of the Defense Department's existing software is administrative. Payroll (the example you gave in response to my previous letter), personnel, inventory, and procurement are just a few examples. These applications are spread over many different machines, all requiring their own versions of commonly used software. Ada, through its packaging facility, can be built to support truly machine-independent file and screen handlers. Therefore, Ada can support fully portable applications.

I believe that if the Defense Department is successful in reaching its goal of portability, the private sector will sit up and take notice. From all I have read, Defense is expected to offer over 300 contracts worth \$750 million by the end of 1985. By the beginning of the 1990s, that figure could reach \$30 billion per year. With this level of expenditure, the commercial tools will be developed within Ada, and the private sector will begin to slowly phase out COBOL. It may take a decade or more, but COBOL's days are numbered.

In my previous letter to PC, I may have intimated that PL/I was a failure as a language. On the contrary: it's an exceptionally good and powerful language, rich with features. It failed only because there was no mass exodus away from COBOL and FORTRAN to the PL/I

promised land as IBM envisioned.

While PL/I and C are both great languages with loyal followings, their creators are not offering huge amounts of money if you write software for them in their language.

I hope that this letter has clarified my previous one and that I haven't offended the large number of COBOL, FORTRAN, PL/I, and C programmers who read your fine magazine.

Russell L. King
Medford, Oregon

We're slowly coming around to your point of view. Perhaps the cash incentive will do what PL/I couldn't do to COBOL and FORTRAN. It's likely, though, that the commercial sector, unable to offer the same incentives, will move much more slowly than the Department of Defense.—Ed.

Blowing the Fuse

I enjoyed the collection of articles about ergonomics; however, I shuddered when the sidebar to "Straining to See the Screen," discussed incandescent lamps (PC, Volume 3 Number 19). Let me blow the whistle and point out the danger inherent in incandescent bulbs.

When an incandescent bulb burns out, that dying flash of blue light accompanies a pulse of interference that wreaks havoc with main memory. It happened to me, causing my XT to reboot.

Now, I'm no electrical engineer, so I don't know if this is also a problem with fluorescent lights. I also don't completely understand the problem. It seems to me that it could either be an electrical surge or radio frequency interference. The problem could possibly be avoided with a power line filter or if the lamp is plugged into a different circuit.

I'm not sure if the problem can be avoided, but beware—a lamp may be a ticking time bomb just waiting to zap your RAM.

Kendall Callas
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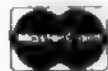
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LETTERS TO PC

Corrections:

Readers are trying to find the names and addresses of the manufacturers or designers of the ergonomic computer workstations featured in "Workstations That Fit" (PC, Volume 3 Number 19).

The workstation on page 169 is DataBord 920 furniture from Krueger, P.O. Box 81000, Green Bay, WI 54308, (414) 468-8100.

The office on the upper left-hand side of page 170 was designed by Neville Lewis Associates, 1910 Pacific Ave., Suite 500, Dallas, TX 75201, (214) 741-2280. The workstation on the upper right-hand side is the Com System by Krueger, as is the Vertebra Systems Chair shown at the bottom of the page.

The workstation on the upper left-hand side of page 171 is the Conwed System 2 furniture by Conwed Corporation, P.O. Box 64237, St. Paul, MN 55164, (612) 221-1102. The desk shown on the upper right-hand side of the same page is the Model EF 211 from Rakks Space Management Systems, Rangine Corporation, 114 Union St., Millis, MA 02054, (617) 376-4545. The workstation on the bottom of the same page is another variation of the Com System by Krueger.

If you were confused by the example given in reply to "Bugs?" in User-to-User (PC, Volume 3 Number 19, page 349)—which mistakenly ran after "Some Miscellaneous Tips"—it's understandable. The DOS statement should have been: REN/ S*.PIC/ *.TMP, not REN/#S*.PIC/#*.TMP. The # sign is the typographical symbol used to show where a space should be.

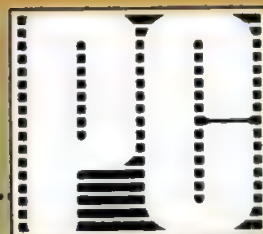
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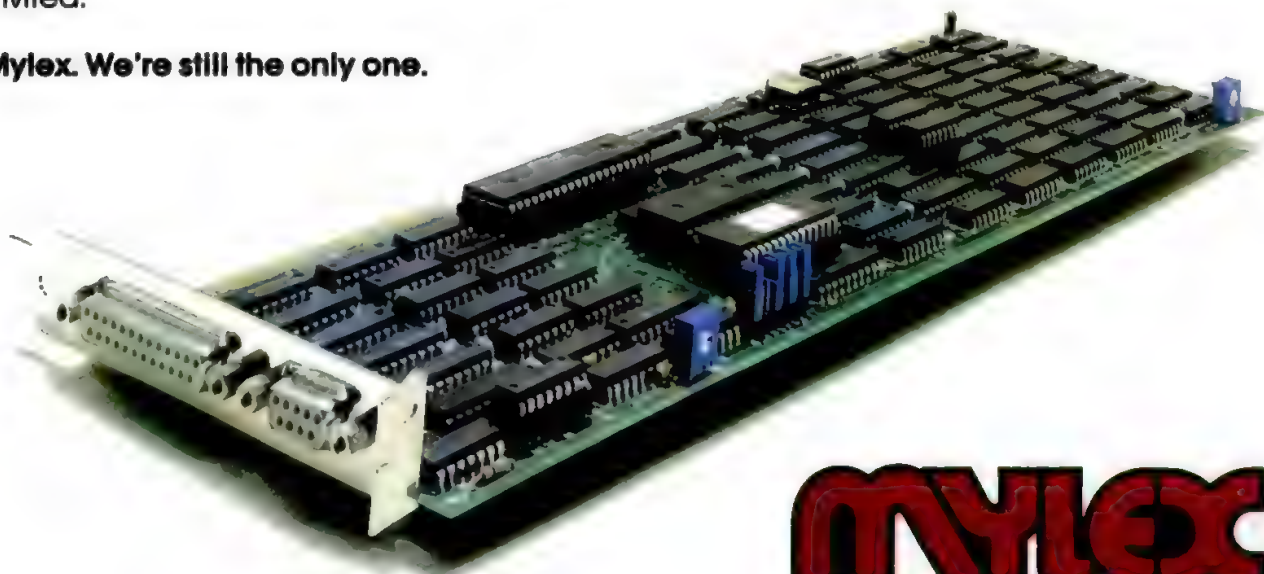
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CIRCLE 372 ON READER SERVICE CARD

A Pragmatic Look at Printers

In this issue, Norton takes printers to task. Which one is the niftiest? Which is the most loathsome? Why do we hate our printers? And when it comes time to buy one, how do we choose?

When the Enforcers called, they said, "It's going to be a 100 percent printer issue. Do a printer column or you're finished." What the Enforcers didn't know is that I had been trying to figure out how to get them to accept the printer column that I'd been dying to do.

You see, I've got a real love-hate thing going with my printers. With all my other equipment, it's pure love. But when it comes to the printers attached to these machines, that's another story.

This is a common experience. Printers seem to be the least satisfactory part of our computer setups. I've bought five printers. The guy downstairs, who is a professional writer, I think, has bought three *expensive* printers, and now he's contemplating getting another.

There is a lesson in this: It's hard to find a printer that you really like. Let me talk about some of the printers that I'm familiar with (whether I own one or not) to give you my perspective on what I think is worthwhile in the printer world.

Unconventional Greatest Hits

The printer I hate the most is the Smith-Corona TP-1. It's noisy, slow, and it gets easily confused about simple commands.

The printer that I think is the niftiest (not the best, just the niftiest) is Hewlett-

Packard's little ink jet printer with the overcute name, ThinkJet. It's a small, quiet, lovely machine. It has its disadvantages, though—a lousy dot matrix typeface and no carbon copies (since it's



Peter Norton

not an impact printer). Moreover, ThinkJet works better with special ink jet paper. But because it's so small and light (and quiet), I think the ThinkJet is the perfect companion to a portable PC.

The printers that I'm most in awe of, and would like to have, are the good laser printers that OEMs are making with the new Canon photocopier print engine. Perhaps the best (certainly the best-priced that I know of) is Hewlett-Packard's version, which it calls the LaserJet. A much-admired friend of

mine turns up his nose at H-P's LaserJet because it doesn't take the graphics abilities of Canon's print engine to the limit, but I'm pretty darned impressed with the breathtaking quality of the print images. Laser printers are the state of the art when it comes to print quality, and H-P's LaserJet does it up well.

Conventional Greatest Hits

In the more conventional realm, away from the high-tech shoals of ink jets and laser xerography, the printers that I'm most impressed with are the new generation of high-quality matrix printers. The one I know best (from my neighbor downstairs) is the Toshiba 1351. What is commendable about the 1351 (and its close competitors) is that it not only does crude, draft quality printing very quickly, it also does really good letter quality printing. The folks who make this kind of printer are usually very modest and say it is "near-letter quality," but to my eye the Toshiba 1351's near-letter quality print is better than what you'd get from a lot of office typewriters. To top it off, you can get italics and boldface and all that stuff too. Now that's a printer.

The drawbacks to these super high-quality matrix printers are that generally they are noisy, and many of them are big and take up a lot of space. But for terrific versatility, this class of printer is tops.

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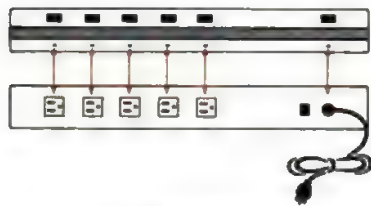
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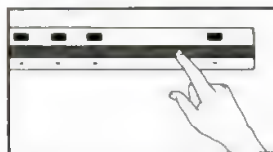
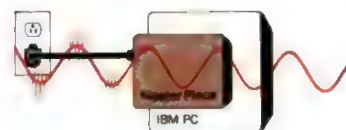


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Why We Hate Our Printers

The variety of printers available is very confusing, and that doesn't help us when we're trying to pick one to buy.

Another burdensome aspect of the printer world, besides the mind-boggling variety of printer features we have to choose from, is the cripplingly huge variety of printer commands that has to be dealt with by our programs (and occasionally by us as well). To make the point, let's look at what two of the smartest word processing programs (the ultimate, *Microsoft Word*, and the wonderworker, *Framework*) have in the way of printer drivers. Care to guess? It's about *three dozen* each. That's over 30 sets of (generally screwball) printer command structures, and that covers just the most popular ones.

This situation, frankly, is a disaster. The community of printer makers and designers are doing us—the community of PC users—an incredible disservice. Each time an important new printer appears with its own special commands, the folks who make our word processing programs have to scramble to accommodate them. What happens when you buy a new printer that your old word processor doesn't support? If you're lucky, whoever made your word processor has already prepared a printer driver to take care of it. More likely, your word processing producer hasn't dealt with the new printer (because it's "not important enough" yet, meaning it hasn't sold enough to create demand for support). Or, even more frustrating, there may be a new printer driver to accommodate your old word processor, but you can't get it unless you buy a whole new version of the program. This is a nightmare.

And don't think that the emergence of de facto standards is making things much better. That's helping somewhat, but not as much as you might think. Case in point: When IBM first brought out the PC, it sold the venerable Epson MX-80 along with it (under IBM's own brand name). That made the IBM print, by def-

inition, 100 percent compatible with the dominant de facto standard, the MX-80. Then, when IBM gave us a graphics printer, it based it on Epson graphics conventions, but IBM changed it just enough to guarantee some incompatibility. And so it goes.

Dear Readers

What kind of advice can I offer from experience? Since there is such a wide variety of needs, and printers to fill those needs, you can't boil things down to recommending a handful of brands and

I've installed tractors
on most of my
printers that didn't
come with them.
Now I think that's a
mistake.

models. But I have some advice; decide for yourself what can help you.

First, and most important, *don't under-buy*. This is the biggest and most common mistake you can make. Don't buy a cheap printer if you can afford a better one. I know too many people—myself and the guy downstairs included—who ended up wasting money by replacing a cheap printer with a better one. It would have been less expensive to get the better one in the first place.

Second, don't assume you don't need speed. You may not; a slow printer might be dandy for you. But plenty of people I know ended up unhappy with their slow printers. Some people upgrade to another printer not for the sake of print quality, but just for more speed.

Third, consider noise. If you value your sanity, noise should be a major factor in your choice. When people are working around printers, especially in an office situation, noise is extremely important, and enclosing a printer in a

soundproof cabinet usually isn't a satisfactory answer. The noise factor works against most matrix printers as well as daisywheel printers. If you need letter quality impact printing, some relatively quiet daisies and even matrix printers can fill the bill. But if you don't need letter quality, there's no better antinoise solution than Hewlett-Packard's ThinkJet.

Fourth, consider space. Good printers generally occupy a good amount of space. If space is at a premium, that leaves you with the more plain dot matrix printers. Once again, H-P's ThinkJet stands out: It's actually smaller than a sheet of letterhead stationery.

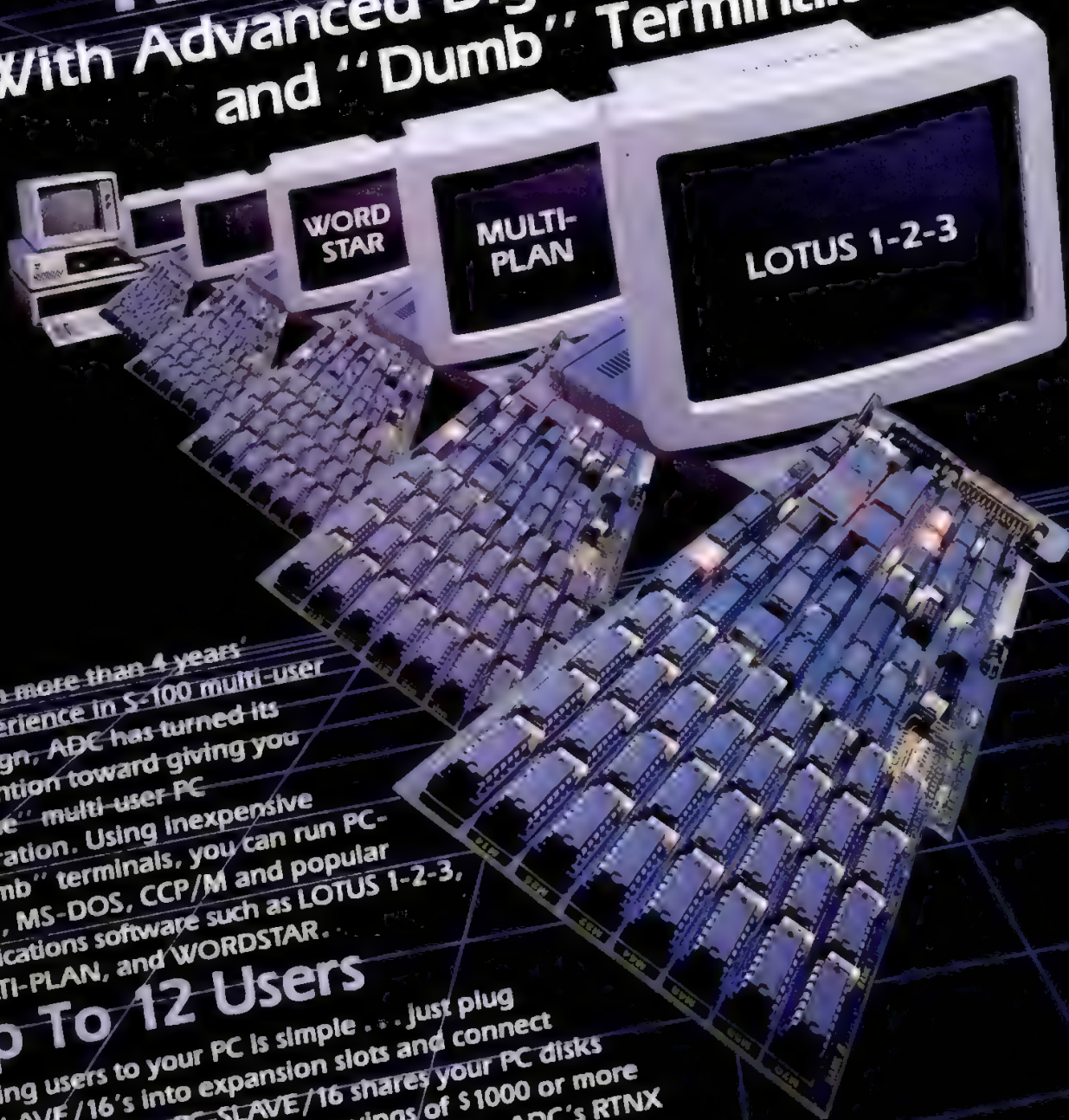
Fifth, consider how you'll feed the beast. I've been a fan of tractor-feed and have installed tractors on most of my printers that didn't come with them. Now I think that's a mistake. If you have to feed continuous forms into your printer (such as gummed address labels, invoice forms, and the like) a tractor is the ticket, but otherwise it's best to have a cut sheet feeder. A cut sheet feeder is perfect for working with envelopes, business stationery, and other odd printing jobs. When you need to print long documents onto plain paper, a cut sheet feeder makes life much easier than a tractor-fed printer does (with tractor paper, you're left with the chore of tearing off the perforations).

Sixth, consider printer memory buffers. While print-spooling software (like the DOS command PRINT) can solve the problem of your computer's being tied up while printing, it has plenty of problems. Here's one place where I prefer a hardware solution, with dedicated print-spooling memory. My Daisywriter 2000 has about 48K of memory to absorb printing as fast as the computer can spit it out, and I love it. But, better than using memory inside your printer (which is tied to only one printer), you can use a separate printer buffer, like the Microfazer buffers and similar products, with any new printer you switch to in the future.

That's my pragmatic perspective on printers. ■

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A HARD LOOK AT

Printers determine how your PC's data make the critical transition onto paper. PC devised a battery of tests to judge just how well each one did the job.

Put it down in writing." "Let's see it in black and white." "Show me." "Get it down on paper."

When communications are important, they're written. The written word embodies knowledge, and knowledge is power.

Today, the printed word takes the written word one step further. The printing press changed books, and the typewriter changed business correspondence (and ruined handwriting) forever. And despite the dramatic changes computers have wrought in their brief history, words and numbers on a screen are still suspect, fleetingly transitory. But when computer output goes down on paper, it seems infallible. Or as one wry aphorism says, "Garbage in, gospel out."

How that output goes on paper (and thus the kind of authority it assumes) is often determined by the printing device used. Today's printer is a magnificent fusion of the arts of the mechanical engineer, the electrical engineer, and the programmer, and a testament to their progress. The technology available for a few hundred dollars today wasn't avail-



HARD COPIES



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Photography: Les Morsillo; photo location: Museum Village, Montecito, N.Y.

A LOOK AT HARD COPIES

able at any price just 5 years ago.

Testing Them All

This issue reports the results of *PC's* tests of 120 printers. Our unique free-for-all, test-'em-all approach relieved us of the burden of selecting a subset of the marketplace germane to what we think are your interests. And the manufacturers didn't have to lobby to get their products included; we went looking for every PC-compatible printer we could find.

You may recall that we conducted a roundup of popular printers, on a much smaller scale, just over a year ago (*PC*, Volume 2 Number 5, "A Plenitude of Printers"). Some of the top contestants in that test have fallen to the middle of the pack this year. That's what happens when those engineers and programmers get busy. Not only do they attempt to eclipse one another's efforts, but they are loath to rest on their laurels. More and better printers are now locked in mortal combat for your attention and your dollars. This competition takes place in two distinct arenas. One is your computer dealer's showroom. The other is the mail-order section of magazines such as this one. Have you ever noticed that some printers seem to live only in mail-order catalogue pages and others inhabit only showrooms? Of course, some can be found in both places, but for some reason printer manufacturers tend to be good at only one distribution channel.

You may also have noticed that few printer manufacturers advertise heavily. And when they do advertise, they seldom include print samples or other information to help you make an intelligent purchase. These companies mistakenly assume that your decision is based on price and availability, nothing more. Furthermore, many printer manufacturers seem to equate personal computers with the home market. Few manufacturers, especially those of dot matrix machines, actually target the office environment, where the ability to switch from continuous forms to letterhead and back again is often important.

All the printers we tested respond to escape sequences and other control codes. Some of the newer entries also sport front panels that give you some manual control over what the printer is doing. Is this a step forward or a useless fillip?

Similarly, it appears to be axiomatic that the faster a printer prints, the worse its paper-handling design. Some of the best printers we tested were absolute bears to load paper in. Others give new meaning to the phrase "down and dirty" when it comes to loading ribbons. There are shining exceptions to these rules, and our reviewers share the results with you. That's what this issue is all about.

Our tests also included the first meaningful comparisons of color printers and laser printers. We even found a color printer that gives the best of the noncolor printers a run for their money. Hewlett-Packard's incorporation of Canon's laser print engine will tickle your fancy, even if you can't afford it. Its output approaches that of a typesetting machine on an off day.

Organization

Despite the overall preponderance of Japanese printers in the marketplace, no country has a lock on the technology. Innovative machines are available from Europe, the United States, and the Far East. In fact, it is sometimes difficult to determine the nationality of a particular machine, since so many intermix components and subassemblies from various sources. One of our first challenges was to weed out the duplicates—cases in which one machine is identical to another, except for its name or the color of the case.

With this in mind, we've approached the printer market as you would, organizing it first by type of printer, then by price. We weren't looking for an all-out champi-

on in each category. Life isn't like that. Instead, we've given you the objective facts, as well as the subjective hands-on evaluations of our testers. We've included blowups of type samples from every printer so you won't have to take anybody else's word on output quality. *PC's* art department did all the enlargements in-house, ensuring consistent quality and

Despite the overall preponderance of Japanese printers, no country has a lock on the technology.

comparability. And the testing procedures were designed to simulate the situation you face when confronting a new printer. Each printer's performance and features were evaluated in a software environment simulating printer drivers found in popular word processing and other PC packages that make heavy use of printers.

A great deal of careful planning went into the printer testing and evaluations to ensure that we conducted them as fairly and consistently as possible. The printers were divided into four categories that reflected their basic technology or notable talents. The large dot matrix and fully formed character printer categories were further divided into price groups that reflect competitive units in their respective marketplace. Color printers and advanced-technology printers made up separate categories.

We gave each author a detailed Author's Guide that described how to evaluate a printer and even described how to write about one in the compressed format required by the scope of this issue. They were told to assume they had just purchased the printer and were trying it out

for the first time. The guide required only that they knew how to unpack and hook up a printer (as spelled out in IBM's *Guide to Operations* for the PC), but gave them plenty of warnings about perils and pitfalls to watch for.

Once the printer was unpacked, the guide requested the author to read the manual or at least enough of it to find out how to run the printer's built-in "self test" that makes sure the printer is functioning. The next level of testing required hooking the printer to the PC's parallel port (or the serial port on rare occasions), booting the system using a PC-supplied disk, and using a standard Shift-PrtSc test to make sure everything was properly connected.

PC also furnished a disk containing compiled test programs to each author. CHARS.BAS, the simplest program on the author's disk, simply printed the IBM character set. Both the low-order (the alphanumeric characters from ASCII 32 through ASCII 127) and the high-order character set were included. We did not include the lowest characters (ASCII 0 through 31) and their companions in the high-order range because most printers use them for action codes, such as Line Feed and Form Feed.

Compatibility

The low-order range of characters is universal, and any printer should be able to print it. Continuing to print the entire range without crashing indicates a greater level of PC-compatibility. Full compatibility means the upper range matched the IBM extended-character set.

The program disk contained additional software that was developed to help authors quickly discover the printer's available features and to determine how well they worked. A SETUP.BAS program (see Figure 1) enabled and disabled printer features by entering command sequences through a modified use of the PC's keyboard and displayed the results on the printer.

To explore the features available in each printer and learn their associated

```

1000 ' PC:Project Printers SETUP.BAS - Use Printer Features
1010 ' Dickinson, 7/84
1020 '
1030 CLS: KEY OFF
1040 FOR KEYS = 1 TO 10
1050   KEY KEYS, ""
1060 NEXT
1070 PC.HEADERS = "PC Magazine: Project Printers Feature Setup Program"
1080 PC.HEADERS = PC.HEADERS + STRING$(70-LEN(PC.HEADERS), 32) + DATE$
1090 LOCATE 25,1: COLOR 15,0: PRINT PC.HEADERS;
1100 '*** Get Author & Printer Info
1110 LOCATE 1,1: COLOR 7,0
1120 PRINT
1130 WHILE AUTHORS = ""
1140   LINE INPUT "Please enter your name: "; AUTHORS
1150 WEND
1160 PRINT
1170 WHILE MODELS = ""
1180   LINE INPUT "Please specify printer make and model: "; MODELS
1190 WEND
1200 PRINT
1210 WHILE NUMBER = 0
1220   INPUT "Please specify printer tag number: "; NUMBER
1230   IF NUMBER <= 0 OR NUMBER > 250 THEN NUMBER = 0
1240 WEND
1250 PRINT
1260 '*** Print header info on printer
1270 LPRINT CHR$(12)
1280 LPRINT
1290 LPRINT PC.HEADERS
1300 LPRINT
1310 LPRINT "      Feature test for: ["; MODELS; "]"
1320 LPRINT "      Tag Number is: ["; NUMBER; "]"
1330 LPRINT "      Author is: ["; AUTHORS; "]"
1340 '*** Continuous loop to try features
1345 DOINGS = "Y"
1347 WHILE DOINGS = "Y"
1360   PRINT
1370   '*** Go get Printer Command Sequence Data
1372   ENABLES = ""; DISABLES = ""; ENABLE = -1
1375   COLOR 15,0: PRINT "Enter Command Sequence to Enable Feature(s):";
1376   COLOR 7,0: GOSUB 3000: ENABLES = SPECIALS
1378   ENABLE = 0
1380   IF ENABLES <> "" THEN COLOR 15,0:
1381     PRINT "Enter Command Sequence to Disable " + SPECIAL.DESCS +
1382       " "; COLOR 7,0: GOSUB 3000: DISABLES = SPECIALS
1400   '*** Set up printer, give instructions
1410   FOR TIMES = 1 TO 2
1420     LPRINT
1435     LPRINT "Before Feature . . . " + ENABLES + "After " +
1436       SPECIAL.DESCS + " feature was enabled, Code = " +
1437       SPECIAL.STRG$
1450     LPRINT "Full line with " + SPECIAL.DESCS + " feature enabled."
1452     LPRINT DISABLES + " " + SPECIAL.DESCS + " is now disabled."
1455   NEXT
1460   DOINGS = ""
1462   WHILE DOINGS = ""
1463     PRINT
1464     LINE INPUT "Do you want to try more features? "; DOINGS
1466     IF DOINGS <> "" THEN DOINGS = CHR$(ASC(DOINGS) AND 95)
1468     IF DOINGS <> "Y" AND DOINGS <> "N" THEN DOINGS = ""
1470   WEND
1480 WEND
1490 '*** Wind up
1495 PRINT
1500 LOCATE 24,1: COLOR 7,0: PRINT PC.HEADERS
1510 LOCATE 25,1: PRINT STRING$(80,32)
1515 LPRINT CHR$(12)
1520 END
3000 '*** Get special characters from keyboard
3010 NOT.DONE = -1
3020 WHILE NOT.DONE
3030   PRINT
3040   PRINT "Enter the printer's special feature command sequence characters"
3050   PRINT "by pressing the keystrokes you wish to transmit to the printer."
3060   PRINT
3070   PRINT "NOTES: Press [End] key when done."
3080   PRINT "      Press [Home] key to re-start."
3090   PRINT "      Press [Ins] key for ASCII 0."
3100   PRINT

```

(Figure 1 continues)

Figure 1: A SETUP.BAS program to enable and disable printer features.

A LOOK AT HARD COPIES

```

3110 SPECIAL = ""
3120 IF ENABLE THEN SPECIAL.STR$ = ""
3130 PECKING.AT.KEYS = -1
3140 WHILE PECKING.AT.KEYS
3150   X$ = ""
3160   WHILE X$ = ""
3170     X$ = INKEY$
3180   WEND
3190   WHILE LEN(X$) > 0
3200     WHILE LEN(X$) = 1
3210       PRINT "[", ASC(X$), "];"
3220       SPECIAL = SPECIAL + X$
3230       IF ENABLE THEN SPECIAL.STR$ = SPECIAL.STR$ + "[" +
          STR$(ASC(X$)) + "]"
3240     X$ = ""
3250   WEND
3260   WHILE LEN(X$) = 2
3270     Y$ = X$: X$ = ""
3280     IF Y$ = CHR$(6)+CHR$(82) THEN X$ = CHR$(6) ' Ins Key
3290     IF Y$ = CHR$(6)+CHR$(79) THEN NOT.DONE = 0:
          PECKING.AT.KEYS = 0 ' End Key
3300     IF Y$ = CHR$(6)+CHR$(71) THEN PRINT:
          PECKING.AT.KEYS = 0 ' Home Key
3310   WEND
3320 WEND
3330 WEND
3340 WEND
3345 IF NOT ENABLE THEN RETURN
3350 IF SPECIAL = "" THEN SPECIAL.STR$ = "[None]"; SPECIAL.DESC = "None";
          PRINT: RETURN
3360 PRINT
3362 SPECIAL.DESC = ""
3365 WHILE SPECIAL.DESC = ""
3370   LINE INPUT "Enter Description of Special Feature: ", SPECIAL.DESC
3375 WEND
3380 PRINT
3390 RETURN

```

(Figure 1 ends)

Figure 2 - SPEED.BAS Printer Speed Test

```

1000 ' PC:Project Printers SPEED.BAS - Use File "TESTDOC" to test speed
1010 ' Adapted from PC, 11/82, Nachrons, 6/83, Dickinson, 7/84
1020 '
1030 DIM TEST$(256)
1040 CLS: KEY OFF
1050 FOR KEYS = 1 TO 10
1060   KEY KEYS, ""
1070 NEXT
1080 PC.HEADER$ = "PC Magazine: Project Printers Speed Test"
1090 PC.HEADER$ = PC.HEADER$ + STRING$(70-LEN(PC.HEADER$), 32) + DATE$
1100 LOCATE 25,1: COLOR 15,0: PRINT PC.HEADER$;
1110 '*** Load Data from file "TESTDOC"
1120 OPEN "TESTDOC" FOR INPUT AS #1
1130 LOCATE 1,1: COLOR 7,0: PRINT "Loading Data . . . ";
1140 NLINES = 1
1150 WHILE EOF(1) = 0
1160   LINE INPUT #1, TEST$(NLINES)
1170   IF EOF(1) = 0 THEN TOTCHARS = TOTCHARS + LEN(TEST$(NLINES));
          NLINES = NLINES + 1
1180 WEND
1190 CLOSE #1
1200 PRINT "Done!"
1210 '*** Get Author & Printer Info
1220 PRINT
1230 WHILE AUTHOR$ = ""
1240   LINE INPUT "Please enter your name: "; AUTHOR$
1250 WEND
1260 PRINT
1270 WHILE MODEL$ = ""
1280   LINE INPUT "Please specify printer make and model: "; MODEL$
1290 WEND
1300 PRINT

```

(Figure 2 continues)

Figure 2: The SPEED.BAS program helps you avoid disk access slowdowns.

command sequences, authors had to pore over the manuals in some detail. PC provided a complete IBM PC extended ASCII character set translation table to help them translate ASCII codes supplied in decimal or hexadecimal notation into character notation.

Since there are no prevailing standards for printer compatibility, we thought it would be noteworthy if a printer complied with the command sequences used by IBM's PC Graphics Printer (which are slightly different than those used by the Epson MX-80 Grafrax printer on which it is based). Authors were also instructed to note when a printer was documented, or observed, to be compatible with another brand or model.

Then, of course, we had to answer the question of whether or not the features worked. If they didn't, PC asked the manufacturer to explain why not. In some cases the problem was faulty documentation; other times, the printer's features just didn't work.

Print Quality

Quality is subjective, and the QUALITY.BAS program allowed each author to pick the print enhancement to use for enlarged "portraits" of the printer's "best" output. The program also elicited outputs of varied print quality for use in more elongated "landscapes" of the printer's output. Authors printed out only one line when the printer had no print-enhancement features.

The authors performed an additional output test on dot matrix printers with dot-addressable graphics. The object was to determine if the printer's graphics were compatible with the PC-DOS graphics PrtSc facility. A batch file loaded the resident GRAPHICS.COM program and brought up a typical bar chart on a standard IBM Color Display. The author pressed the Shift-PrtSc key combination to see if the screen dumped correctly.

If a printer showed only minor differences, such as fine splits between graphics bars or slightly overlapping graphics bars,

it was declared compatible. If the results showed wide bars of white space, or if a printer went berserk or died, we declared the printer incompatible.

Printers that arrived with vendor-supplied software for printing graphics screens endured an additional test. This test proved particularly important for color printers, a surprising number of which came with very effective replacements for GRAPHICS.COM. Color-printer specialist Gary Skiba ran additional tests for the color printers, especially if they didn't come with their own software.

Speed

The effective speed test was run two ways. During the first run, no print-enhancement features were enabled; the second time, a combination of features chosen by the author was enabled (they're listed in the printer's chart). The first test indicates effective default (power-on condition) print speed; the second indicates how much the print enhancement slowed down the printer. The second test is critical for dot matrix printers, which need print enhancement to produce acceptable business letters and other high-quality documents.

Since many fully formed character printers disable print-enhancement features every time they receive a carriage return, the enhanced speed test required sending the printer the command sequence for the enhancement each time a line was printed. This resulted in a slight bias against printers that don't disable enhancement features after every carriage return.

The SPEED.BAS program (see Figure 2) read a file containing the text and saved it in memory before running the printer, thus avoiding disk access slowdowns. The program did all the timings and character counts. It ran somewhat differently for buffered printers to account for the fact that the PC would think the printer was done printing when it still had a final buffer full of characters left to print. Preliminary tests showed SPEED.BAS capable of sending over 1,500 characters per

```

1310 WHILE NUMBER = 0
1320   INPUT "Please specify printer tag number: "; NUMBER
1330   IF NUMBER <= 0 OR NUMBER > 250 THEN NUMBER = 0
1340 WEND
1350 PRINT
1360 WHILE BUFF# = ""
1370   LINE INPUT "Is the printer buffered? (Y/N) "; BUFF#
1380   IF BUFF# <> "" THEN BUFF# = CHR$(ASC(BUFF#) AND 95)
1390   IF BUFF# <> "Y" AND BUFF# <> "N" THEN BUFF# = ""
1400 WEND
1410 PRINT
1420 '*** Go get Printer Command Sequence Data
1430 ENABLE = -1: GOSUB 3000
1440 '*** Prompt for keyboard control of timing for buffered printers
1450 IF BUFF# = "Y" THEN GOSUB 1930
1460 '*** Set up printer, give instructions
1470 LPRINT SPECIAL#;
1480 PRINT
1490 PRINT "Insert paper and press [" + CHR$(17) + CHR$(217) +
      "]" key to begin test . . . ";
1500 LINE INPUT START#
1510 PRINT: PRINT ". . . Running!"; PRINT
1520 '*** Start timer, print test file
1530 TIMES = "0"
1540 FOR LOOP = 1 TO NLINES
1550   LPRINT SPECIAL# + TEST$(LOOP)
1560 NEXT LOOP
1570 '*** Stop clock (wait for key on buffered printers)
1580 LPRINT CHR$(7)
1590 IF BUFF# = "Y" THEN GOSUB 1990
1600 ELAPSED# = TIMES
1610 PRINT "Stopped!"; PRINT
1620 '*** Calculate results
1630   MINS# = MID$(ELAPSED#,4,2)
1640   SECS# = RIGHT$(ELAPSED#,2)
1650   MINUTES = VAL (MINS#)
1660   SECONDS = VAL (SECS#)
1670   TOTSECONDS = (MINUTES * 60) + SECONDS
1680   TOTMIN = MINUTES + (SECONDS / 60)
1690   THROUGHPUT = TOTCHARS / TOTSECONDS
1700 '*** Print results on printer
1710 LPRINT CHR$(12)
1720 LPRINT
1730 LPRINT PC.HEADERS
1740 LPRINT
1750 LPRINT "   Throughput report for: ["; MODEL#; "]"
1760 LPRINT "   Tag Number is: ["; NUMBER; "]"
1770 LPRINT "   Author is: ["; AUTHOR#; "]"
1780 LPRINT "   Special feature: ["; SPECIAL.DESCR#; "]"
1790 LPRINT "   Special feature string: "; SPECIAL.STRG#
1800 LPRINT
1810 LPRINT " *** Performance Statistics ***"
1820 LPRINT
1830 LPRINT "Elapsed time was "; TOTSECONDS; "seconds."
1840 LPRINT
1850 LPRINT THROUGHPUT; " characters per second for"; TOTCHARS;
      " characters."
1860 LPRINT
1870 LPRINT NLINES / TOTMIN "Lines per minute for"; NLINES;
      " lines of text."
1880 LPRINT CHR$(12)
1890 '*** Wind up
1900 LOCATE 24,1: COLOR 7,0: PRINT PC.HEADERS
1910 LOCATE 25,1: PRINT STRING$(80,32)
1920 END
1930 '*** Prompt user for buffered printer procedure
1940 PRINT: PRINT "The computer will start the clock. The printer's horn"
1950 PRINT "will sound when it is done printing. When it does, press"
1960 PRINT "any key on the PC's keyboard. This will stop the clock."
1970 PRINT
1980 RETURN
1990 '*** Wait for key to stop clock on buffered printers
2000 PRINT
2010 PRINT "Remember . . . press a key to stop the clock . . . ";
2020 WHILE INKEY# = ""
2030 WEND
2040 RETURN
3000 ' See Figure 1 for Subroutine 3000

```

(Figure 2 ends)

TOUCHSTONE 1



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entry of every keystroke, even when a previous key has not been fully released.

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Touchstone 1 data entry takes about 40% of the movement required with the standard PC keyboard. Even more important, you don't have to take the time to look for each digit.

An example; the formula:
 $((43818 \times 12) + (52 \times 147.3) / (47/12))$
Using the standard PC keyboard

(forget the PC number pad unless you can cope with the NUMLOCK), this formula takes 37 keystrokes including 8 shifts, and hand movement totalling 137 inches. With the Touchstone 1 keypad, the same formula is entered with 31 strokes, including NO shifts, and total hand movement of just 57 inches.

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A LOOK AT HARD COPIES

second through the PC's parallel printer port. The test document consisted of a two-page "typical" business letter and included 3,453 characters of text on 83 lines.

The sound tests were run concurrently with the speed tests and used a calibrated sound pressure level (SPL) meter. Tests were conducted in a normal business office rather than in a laboratory anechoic (echoless) chamber, and measurements were taken at a distance of 1 foot rather

than 1 meter. Thus, the absolute numbers that registered on our SPL meter cannot be compared with those supplied by printer manufacturers. However, our figures do show the *relative* amount of noise generated by each printer tested.

Perceived loudness is affected not only by a sound's intensity but also by its frequency. We combined both factors by making frequency-weighted SPL measurements. We used the customary A-weighting curve (which reflects the human

ear's relative insensitivity to low frequencies at low volume levels), but the test also included a C-weighted (essentially unweighted) figure for comparison. In either case, an increase of 3 decibels represents a doubling of the sound energy created by the printer, though the ear would require a difference of roughly 10 decibels before pronouncing one printer "twice as loud" as another.

Results

Most of the printers survived the tests, some better than others. You can read the results for yourself in the chart and the articles on each printer. A few printers were admitted to be incompatible by their vendors, and we gave up on a few more after a sufficient number of attempts to make them work.

The one broad conclusion to be drawn from the testing is that local dealer service and support can be critical to getting the most out of your printer. About one-third of the printers tested did not hook up correctly the first time they were tried, possessed unworkable features, or had some other problem.

The particular printers we tested came directly from manufacturers and distributors, and the reviewers had only them to rely on for help. With few exceptions (noted in the reviews), the level of support provided by the manufacturer was unsatisfactory. And the size of the long-distance phone bill generated by factory support could have made even the most inexpensive printer uneconomical. In addition, the condition many printers arrived in made it clear that some manufacturers don't even know what the PC's parallel port looks like or how it works!

Buy your printer from a reputable dealer who will set it up for you (DIP switches, cable, the works) and prove to you that it will run on a PC. Better yet, make sure it runs with your favorite software before you leave the store! The right choice will give your computer the ability to put your work on paper quickly, easily, and authoritatively. ■

A GUIDE TO THE PRINTER FACT FILE

The pictures may all be the same size, but the printers aren't. You can get a better idea of the actual size of the machines by comparing them to the ordinary wooden pencil sitting in front of each.

These characters are magnified ten times. The W shows you angles and serifs (if any), and the q shows you a round character along with a descender. Print enhancements were in effect when we produced the type specimens—check the last line of the print quality outputs to see which one was used.

Wq

FACT FILE

Plainprinter 2
The Printer
111 River
Suite 220
Cambridge
(800) 555-5555
(617) 555-5555
List Price

If you want to know more about a printer, write or call the vendor using the information we have supplied. You should also consider checking with a local dealer who carries the make and model you're interested in.

using the Power
using the High
using the High

Authors tried as many printer features as they could and used the best-looking ones to print these sample lines. Each line tells you what feature or combination of features was used. The print options for the last line were also used to produce the enlarged W and q above.

HOW PC PRINTERS

The expanding PC marketplace has spawned a variety of printers. PC classified them by image type, image-production method, interface, and paper-feeding method.

Just as an ecosystem with a growing supply of food can support an ever-greater number and variety of species, the rapidly expanding personal computer marketplace has spawned a variety of printers to match the numerous new market niches.

Only a few years back, printers were devices that merely accepted electronic character codes and produced corresponding character images on a piece of paper. A printer simply acted like a computer-controlled electric typewriter.

These days, a printer may be able to draw shapes, print colors, and even mix text and graphics. Consequently, the definition of a printer must be broadened to include any output device that makes a two-dimensional image on flexible material and that is optimized for the production of characters.

Printers have become a complex technological subject in their own right, and the differences between competing models and technologies have developed into a mind-boggling array of mirrors and magnets, pins and tractors, dots and daisy-wheels—the list goes on.

To make it easier to understand the technologies involved, we'll look at printers for the PC from three perspectives: the type of image produced; how characters and images are formed; and how the printer hooks up to the rest of the system. You can tilt the kaleidoscope another way and divide printers into different classes, but any method of classifying these machines has to account for all of the tasks that a printer can accomplish.

Character Images

One popular way of classifying printers is to look at what kind of character or graphic image they produce. For characters, the primary distinction is between fully formed character models and the dot matrix alternative (Figure 1). There is also a third, less common category of printers that produce stroke characters.

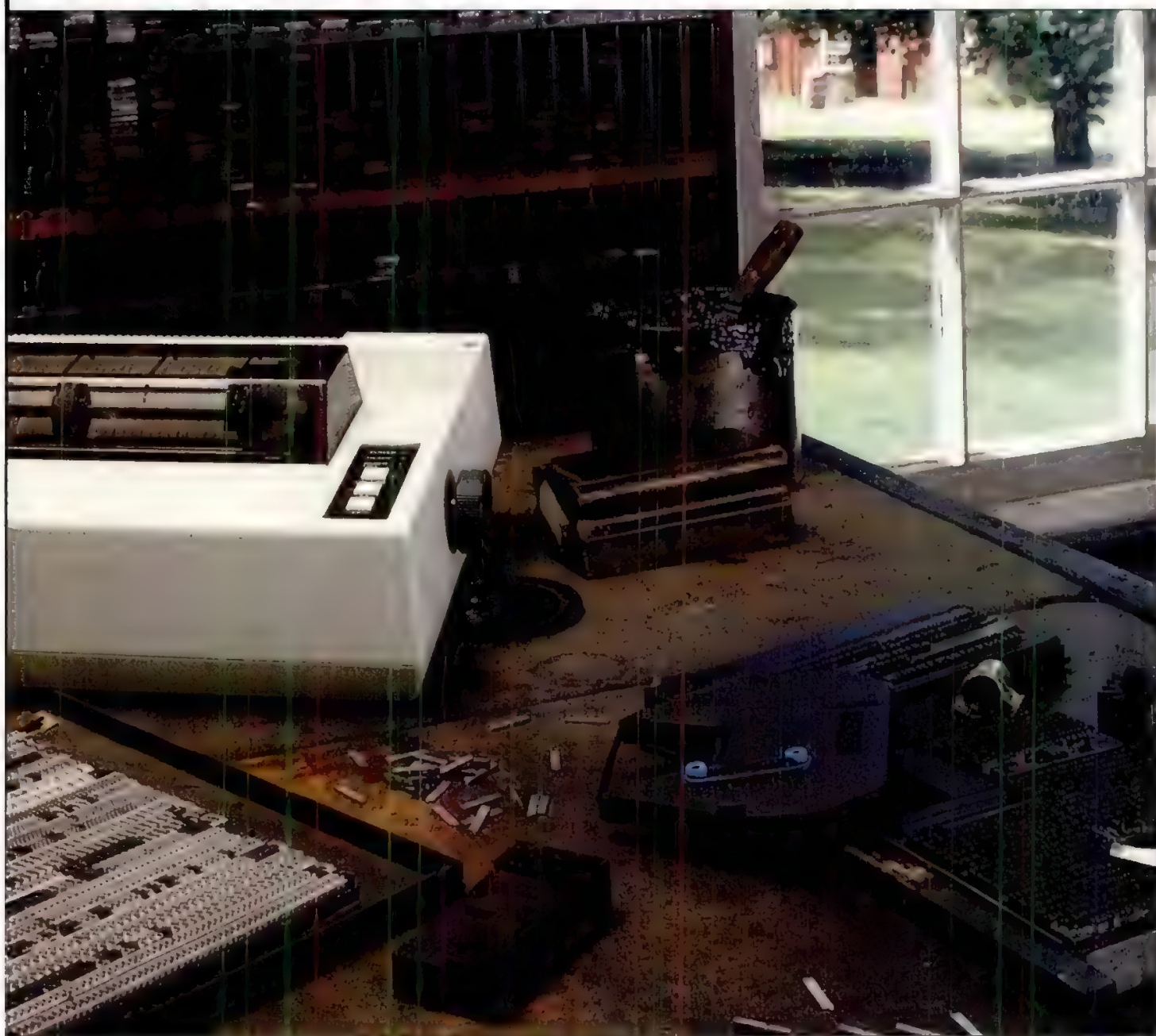
The fully formed character printers include technologies using daisywheels, thimbles, and type balls. These printers carry complete images of each character in their repertoire. As a result, the print specimens are smooth, connected characters with details as fine as the particular technology and mechanism allow.

Dot matrix characters are made up of some combination of dots positioned on a series of grids. A finer grid (more dots per character) allows characters to show more details, but even the higher-density dot matrixes used on many newer printers produce visibly coarser letters than fully formed character models.

Stroke characters are presently used primarily on plotters and other devices that are especially designed for producing non-character output. In this case, the printer



MAKE THEIR MARK



draws each character using a series of line segments and arcs connected according to a pattern stored in memory. So far, this method has not proved fast enough for regular text output.

For producing graphics, a similar distinction can be made between methods (Figure 2). Matrix printers can do dot-addressable graphics, which lets the computer specify the individual dots to print, offering greater flexibility at the cost of high information requirements. Fully formed character printers can do only block graphics, where the printer outputs on command a series of predefined images made up of whole characters.

The Print Quality Issue

How a printer works is important, but when it comes to output, you're probably more interested in how the print looks. If

and represents the top of the line. When equipped with the right ribbon and paper, the output from a good letter quality printer looks as good as or better than print from the best office typewriters.

"Near letter quality" is what vendors of dot matrix printers term their best efforts. Typically, each character is formed from a high-density matrix of more than a hundred possible dots. Most people find this quality level perfectly acceptable for business reports, correspondence, and schoolwork. Naturally, in the absence of any definite standard, some "NLQ" models are a lot closer to letter quality than others.

"Business quality" is a relatively new coinage that's rapidly gaining popularity as a description for a quality level below NLQ but still adequate for internal reports, memoranda, and other projects where

quality output when used in their default print modes.

Getting It Down

How the printed image actually gets onto the paper is another principal way of categorizing various printing methods (Figure 4). Until now, impact printers have been the most popular in the PC marketplace, but nonimpact technologies are coming down in price and becoming more popular in the printer market.

Most impact printers hit an inked ribbon against the paper to create the image. With a daisywheel or ball printer, one raised character at a time strikes against the ribbon. On an impact dot matrix printer, one or more pins push against the ribbon in a succession of dot patterns that form a character or graphic segment.

Impact methods evolved from the typewriter industry, so they're built on a well-explored technology with a good performance record. On the other hand, they're relatively slow, noisy, and incapable of extremely fine graphic renditions.

Most nonimpact methods are, by contrast, rather new, so there's still a wide difference between approaches and results as manufacturers strive to find which arrangements work best. Much of the current excitement in the printer market comes from the emerging nonimpact printing technologies.

The most highly touted of the new nonimpact methods is the laser printer, the common term for laser-based electrostatic devices. Laser printers represent a blending of printer and office-copier technologies. They write the desired image on a copier drum with a laser-light beam that operates under computer control. Once written on the drum, the image is used to attract toner, which becomes fused onto the paper, just as with xerographic copying. Sometimes laser printers are called electrostatic printers because they depend on the workings of fixed-position electric charges.

So far, all of the laser printers developed for personal computers use laser to

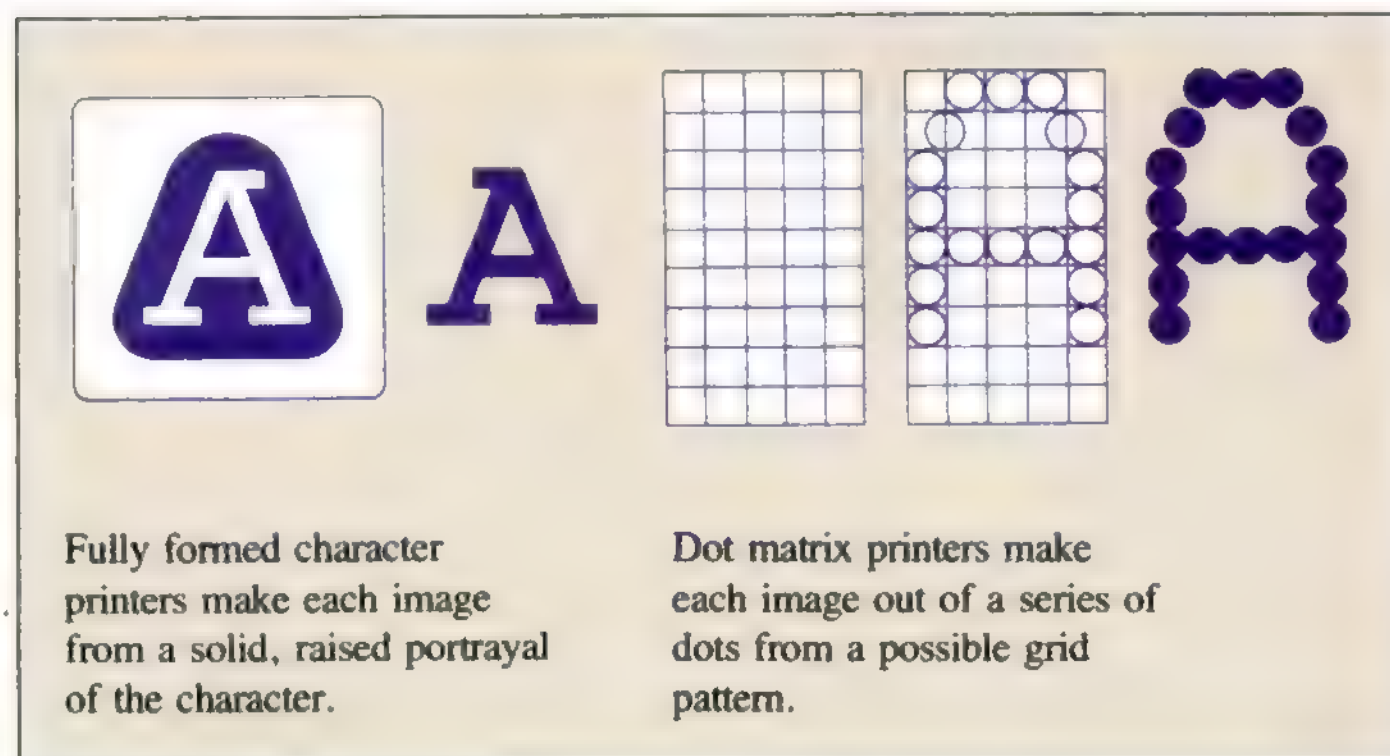


Figure 1: A comparison of the output of dot matrix and fully formed character printers.

you ask anyone who reads computer output, you'll find that fully formed characters rate the best. High-density dot matrix printers (with lots of dots per character) rank second, and low-density dot matrix printers come in last.

No formal classification system has gained widespread acceptance, but industry terminology for describing print quality is starting to converge (Figure 3).

"Letter quality" generally refers to the output of fully formed character printers

clear readability at a lower cost is more important than finely sculpted characters. Most matrix printers that work with a PC can produce this level of output.

"Draft quality" comes last in this ranking; it represents a compromise made to get fast output at the expense of fewer dots per character. As a result, draft quality print has more ragged curves and lighter inking, but it is still adequate for program listings or checking the format of a document. Most matrix printers produce draft

generate the computer-controlled light beam, but some machines made for bigger computers form the image on the drum with magnetic pulses, cathode-ray tube images, or arrays of LEDs. Both laser and nonlaser electrostatic methods form characters out of dots, but the high number of dots per inch produces a near-letter quality result.

Ink jet technology is also a current favorite. With this method, the printer sprays fine droplets of ink to make small dots on the paper that form characters and shapes. Dot resolution is similar to impact methods, but the noise level is reduced to a whisper, if that. Using three or four ink nozzles in one printer creates a color ink jet device, which can reproduce a complete rendition of the PC's color display. Although frequently advertised as plain-paper printers, ink jet models work best with special (and more costly) treated paper.

Thermal transfer is another nonimpact technology with a growing following. This method melts a wax-based ink from the ribbon or transfer sheet onto the paper in a pattern of minute dots to form characters or graphic images.

A last nonimpact method is electroerosion, where an electric current from tiny needles blasts a thin aluminum coating off a black sheet of paper. This method enjoyed a brief prominence in the early days of personal computers owing to the low cost of the mechanism (although the special paper did add up in the long run) and is now enjoying a small comeback because the output reproduces so well for photo-offset printing.

Order on the Page

So far we've talked only about how a single character or graphic segment gets printed without regard to how characters and dots are combined into lines and pages. Most of the printers you'd hook up to a PC are "serial printers" (referring not to the style of the electronic interface, but to the way characters are assembled on the paper). A serial printer lays down each

character or graphic segment in succession, working on one printhead-size region of the paper at a time.

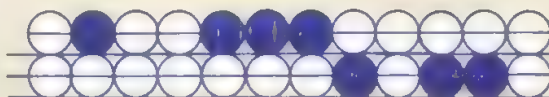
Bigger computers often use line printers, where each printing cycle transfers an entire line to the paper. This method is faster, but the output quality is lower and the cost higher, so it hasn't found much

success in the personal computer arena. Many personal computer printers actually accept a whole line of characters from the computer before they start printing, but they are not true line printers because the characters are then printed one after another, not simultaneously.

Laser printers produce an entire page in

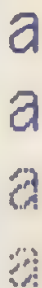


Character graphics combines various shapes the size of characters to form images. Here are images and their codes as provided on the IBM Matrix Printer.



Dot-addressable graphics lets the computer tell the printer exactly which dots out of those possible should be printed. This mode is equivalent to all-points addressable on the video system.

Figure 2: Matrix printers can produce graphics from whole characters or individual dots.



Letter quality is made up of connected lines and curves

Near-letter quality has a high number of dots per character

Business quality has fewer dots per character

Draft or computer quality has the fewest dots per character

Figure 3: As can be seen from comparing the above samples, a higher density of dots on a dot matrix printer yields a higher-quality typeface.

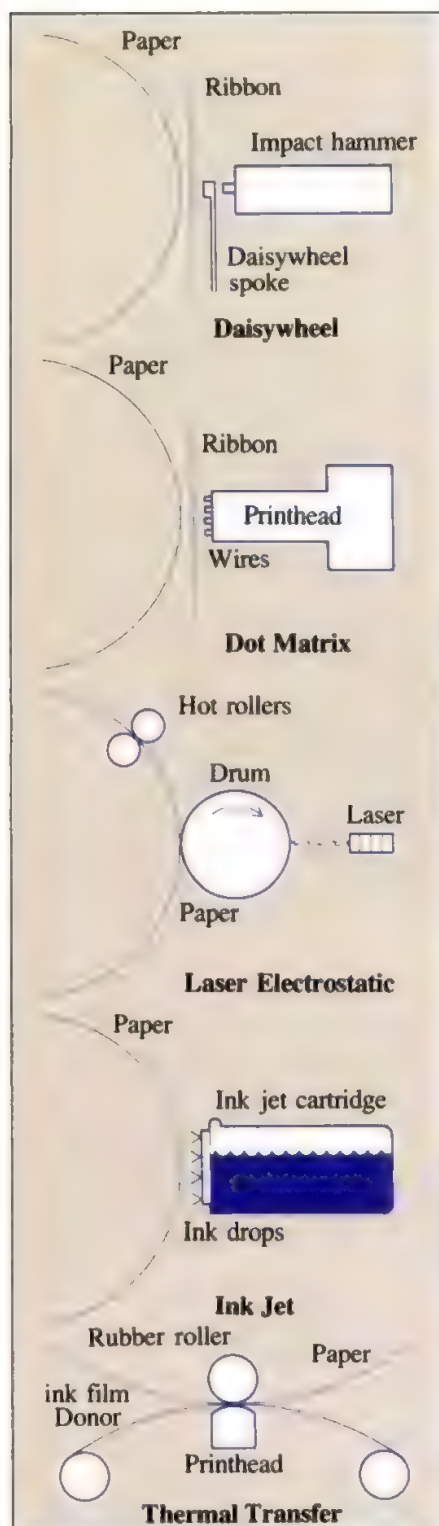


Figure 4: Illustrated above are the five current technologies of computer printing.

each cycle. Like most page printers, their output speed for each page is fixed, whether it has characters on it or not.

Serial printers usually can't run as fast as page printers, but manufacturers are always looking for ways to increase their throughput speed. The newer serial printers with their own microprocessors are able to print alternate lines going backwards from the end to save time. As a further refinement, most models include logic-seeking, meaning that for each new line, the printer decides whether to start printing from the left or from the right depending on which side is closer to the current printhead location. Bidirectional printing almost doubles printing speed, but output quality suffers slightly owing to the difficulty of ensuring accurate registration for lines printed in opposite directions.

Getting Physical

Printers are only the springs where the invisible currents of data appear as visible torrents of characters. The connections, both upstream and downstream, are also important.

On the electronic data end, the choices for a printer for the PC family are the serial or RS-232 connection on one hand, and the parallel or Centronics connection on the other (Figure 5).

The Centronics interface sends each character across to the printer as a set of impulses on eight parallel wires. The printer and computer exchange information on when each is ready for a transfer through a series of hardware status lines.

The serial interface, on the other hand, sends the complete data for each character as successive bits over a single signal line, using the same method employed to send data over telephone lines. Timing and coordination can be done through hardware status lines, but the more frequent practice is to provide a data line back from printer to computer to allow status message bytes to be passed back and forth.

IBM originally supported only the par-

allel Centronics interface for the PC and equipped all of its PC printers with parallel connections. However, many popular daisywheel printers use a serial interface. Fortunately, PC-DOS (starting with Version 2.0) allows a serial printer to be used as if it were hooked to one of the parallel ports.

With either the parallel or serial interface running at a moderate or high trans-

PC-DOS allows a serial printer to be used as if it were hooked to one of the parallel ports.

mission speed, the computer can send data to the printer far faster than the printer can digest and print it. An alternative to keeping the computer (and the user) waiting for the printer is to give it some kind of intermediate electronic storage that can accept data at high speed and hold it for later printing at mechanical speeds.

Printer buffers, or spoolers, provide this type of storage area. Some printers have buffers built into them, but only a few are large enough to hold much more than one page of printed data. Larger buffers can be added to your PC in two ways. External buffers can be purchased and installed between the PC and printer. A less expensive alternative is to use one of the many print spooler software programs that can be attached to the PC-DOS operating system.

Paper In, Paper Out

How well a printer's paper mechanism works often affects the way you feel toward the printer more than anything else, including its print quality. Popular paper-feeding methods include sheet feed, roll feed, pin feed, and tractor feed (Figure

6). A single printer often provides a combination of these alternatives.

Single sheet feeding pulls individual leaves of paper, such as letterhead or envelopes, through the printer much as paper is fed through a typewriter. Sheets can be fed manually, one by one, or through an automatic sheet feeder. Sheet feeders are often optional, and they may cost as much as the printer itself.

Roll feeding sends a single long sheet of paper through the printer but relies on a friction roller to pull it through. It's hard to keep the paper precisely lined up with this method, so it's used mostly for fast rough draft output or unattended data logging.

Two paper-feed methods are available to solve the slipping and misalignment problems of the single sheet and roll methods. Both methods require pin-feed or tractor-feed paper. Pin and tractor feeds work like the chain drive on a bicycle, with sprockets on the printer lining up with regularly spaced holes along the edge of the paper.

On pin-feed printers, the sprockets are mounted around the outside of a single roller that otherwise looks like an ordinary platen. On most pin-fed printers, the platen can also be used for single sheets.

On tractor-feed printers, the sprockets are mounted on a separate shaft. The sprockets can be moved readily in and out to accommodate different sizes of paper. Bidirectional tractors can pull the paper backwards as well as forwards, a necessity for accurate printing of dual columns, certain types of graphics, and other output that requires backwards paper movement.

Another paper feed method is showing up on the newer laser and thermal transfer printers. Sheet paper bins are mounted internally, as in the familiar office copier. The designs are all based on office copiers, so it's not surprising that they use the same paper-feeding technology.

Printers for the IBM PC can be characterized by the type of image they produce, the technology used, the paper feed mechanism, and soon. But when you set out to

buy one of these machines, you're likely to consider price, reliability, and vendor support among your top priorities in mak-

ing a choice. A good place to start is by looking at the printer reviews in the pages ahead. ■

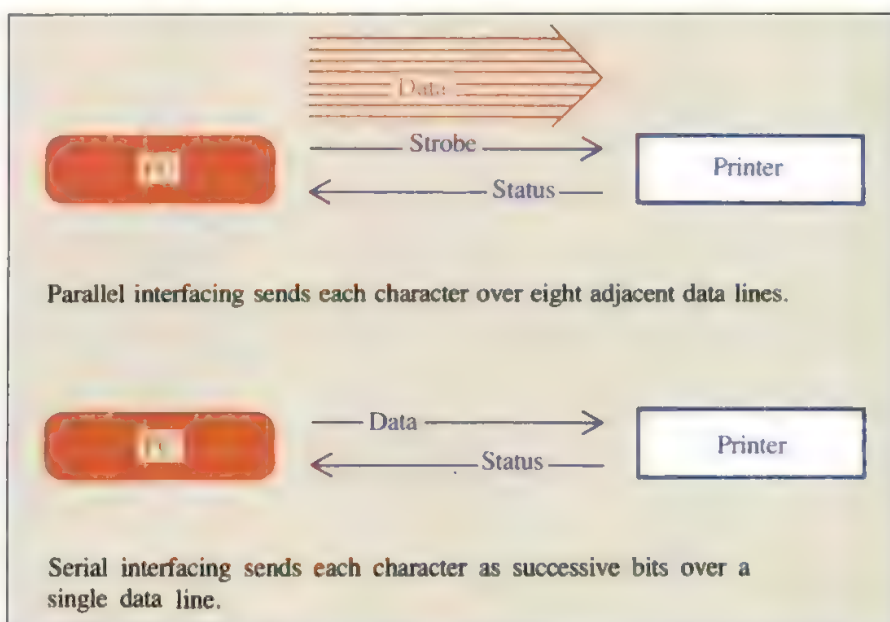


Figure 5: A schematic representation of parallel and serial interfacing.

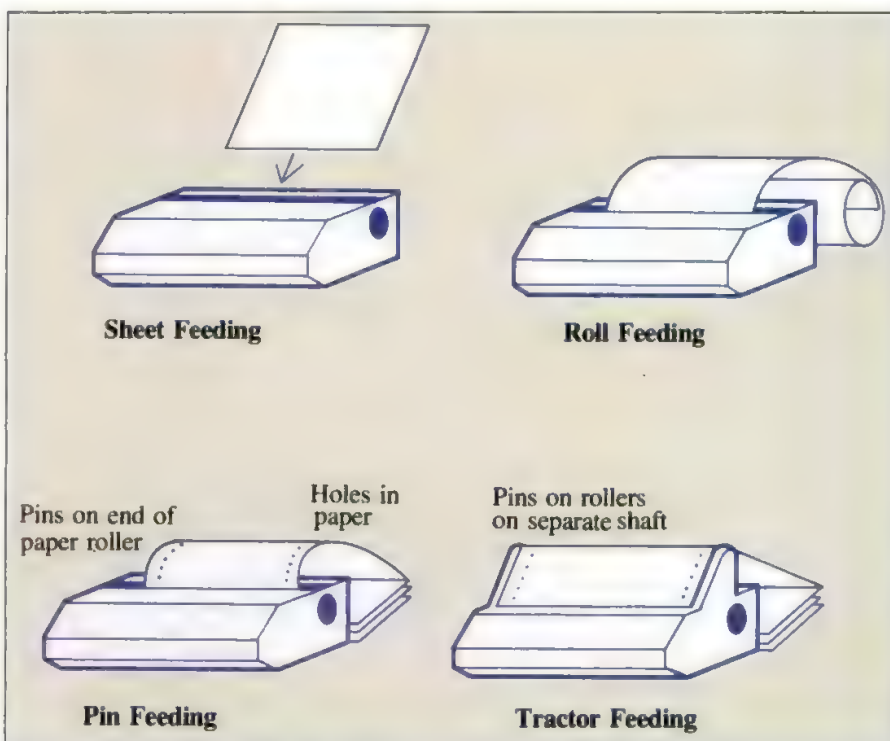


Figure 6: Four methods of feeding paper into impact and ink jet printers.

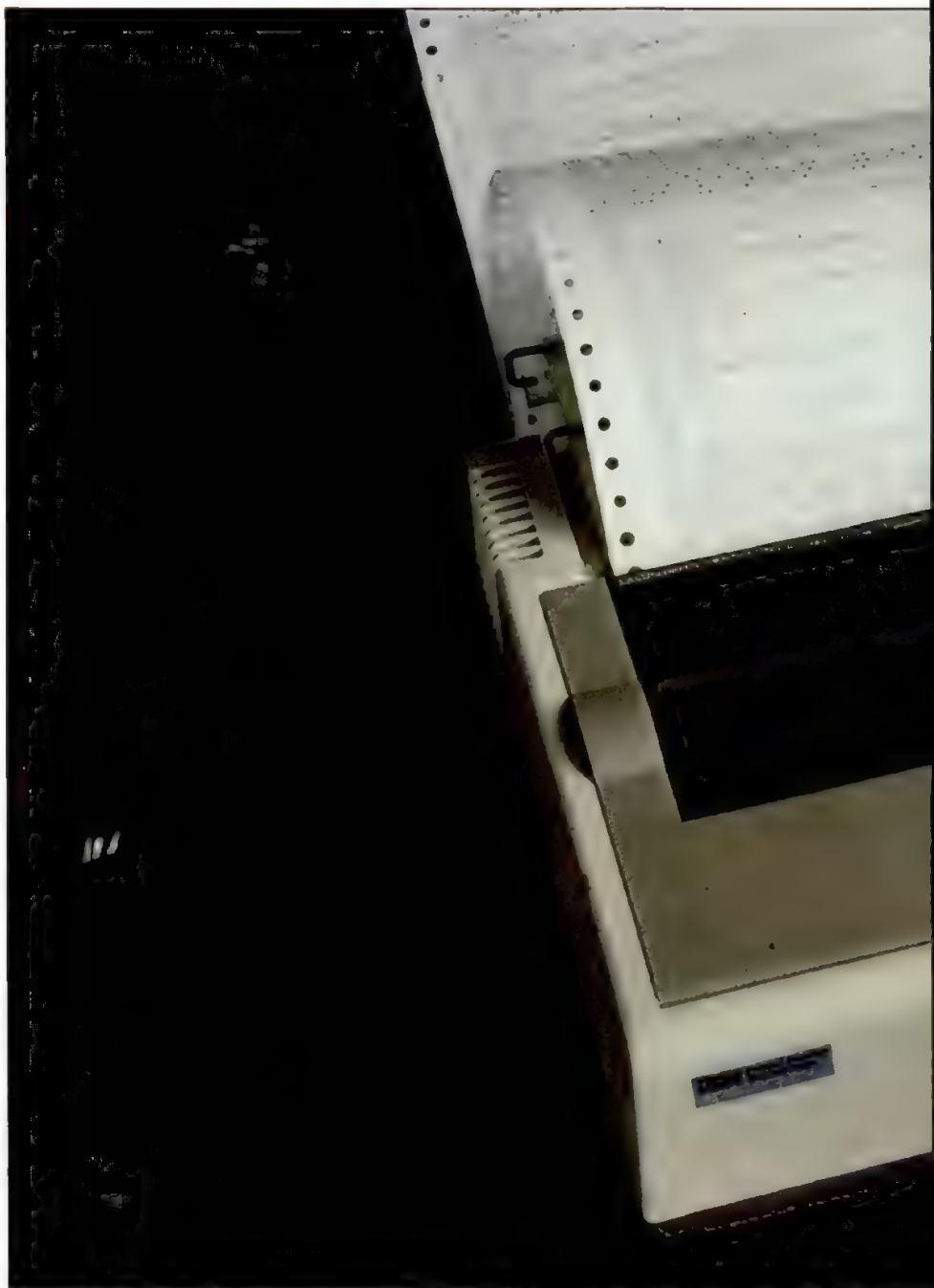
PICKING A WINNER

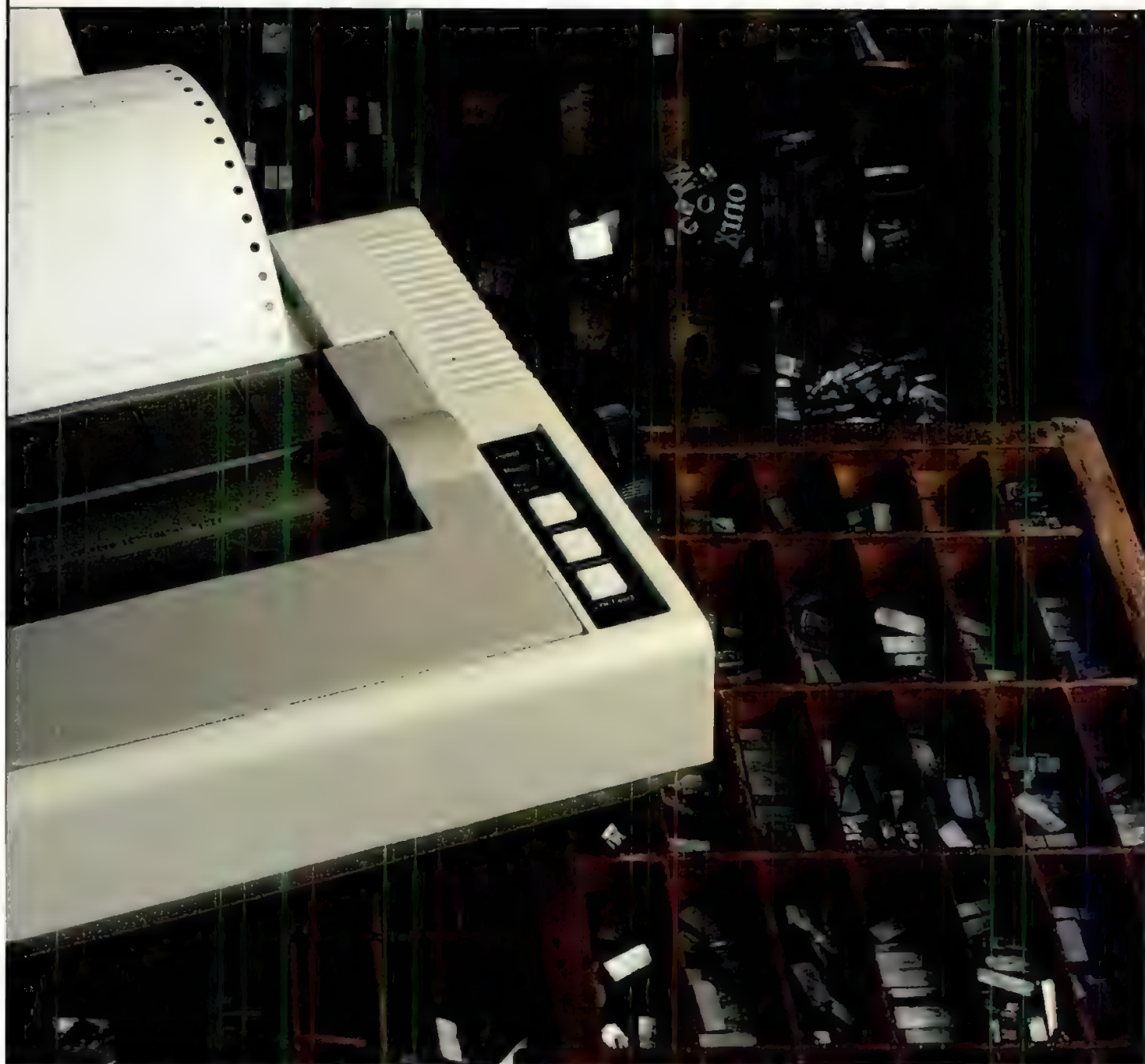
Every printer has strengths and weaknesses. The key is finding the machine that best matches your budget and your requirements.

A printer is usually the first peripheral a PC purchaser buys, and it is also one of the most important. Selecting a printer presents the buyer with many important choices, and the decisions generally have to be lived with for a long time. Unfortunately, many people do not properly evaluate all of the printer options available to them, which can lead to disappointment and frustration when they spot "the perfect printer" after buying something else. It takes some dedicated field work to decide which printer is best for you.

The first word of advice for those of you who are worrying about price is, don't. For this issue, *PC* tested printers ranging in price from \$125 to about \$7,000, so there certainly is a wide enough choice to suit your wallet. More importantly, the old adage "You get what you pay for" applies to computer purchases as much as, or more than, any other kind of buying decision. If you've just gone out and spent several thousand dollars on a computer system that you felt gave the best performance for the price, don't expect to buy a top-of-the-line printer for another \$50.

Also, remember that you can't make a





silk purse out of a sow's ear. If you're a respected attorney, for instance, you probably cannot use a dot matrix printer for your business correspondence. Its output just won't look good enough. Similarly, if you generate 5,000 pages of printed output per day, don't expect an ink jet printer to keep up with the load. And if your work requires high-quality graphics reproduction, don't expect a daisy-wheel printer to do the job. Of course, there are printers that can handle several different types of work, but take care to select the device that best performs the functions you will use most.

Which Type?

The fully formed character printer has always been a mainstay of the computer industry, and the common daisywheel printer is the latest example of that approach. The idea of printing in this manner was taken from the days when printers were little more than glorified electric typewriters. Most offices use daisywheel printers, and they usually produce output as good as or better than a typewriter's.

This is the kind of printer you want if you require consistently high-quality output. Remember, the quality of the print on your letters and other documents tells people something about your business practices, so don't think for a minute that output from an inexpensive dot matrix printer would fool a prospective customer, loan officer, or judge, for example.

Nevertheless, dot matrix printers are a whole other breed of printer, and they may also have an important role to play for you. They are much faster and more versatile than daisywheel printers. Some of them are capable of producing surprisingly good-looking characters, but they are for the most part restricted to printing

program listings and data where output quality is not an important issue. They generally have an excellent price-to-performance ratio.

The venerable IBM Personal Computer printer that the salesman tried to bundle with your system is a dot matrix printer. It's not the fastest printer available at its

Does your manager need voluminous reports in a hurry? If that's what you have to contend with, a dot matrix printer may be just right for you.

price, but it's sure to be compatible and includes a graphics capability.

As you go up in the price range of dot matrix printers, you encounter more features and proportionately higher speeds. The speed factor is critical to programmers doing development work and managers who need voluminous reports in a hurry. Come to think of it, have you ever heard of a manager who *didn't* need a voluminous report in a hurry? If that's what you have to contend with, a dot matrix printer may be just right for you.

You should also check out two relative newcomers to printer technology—ink jet and laser printers. Both are actually specialized versions of the dot matrix printer, since their characters are built up from dots, but unlike the dot matrix they involve little or no physical contact between the printhead and the paper.

Ink jet printers are most notable for two things they lack: noise and bulk. They can be used to produce a reasonable graphics image as well as passable text printing.

The laser printer is also very quiet, and, since it's based on a copying machine, blends right in with most office decors. Its strong point is producing letter quality documents in offices with high throughput requirements—eight pages per minute is a lot of printing! A laser printer also provides excellent-quality graphics, and you can count on seeing applications such as low-cost phototypesetters using these devices. One warning, however: low-cost laser printing is a relatively new technology, so be prepared to deal with minor annoyances when looking for supplies and service.

Where to Buy?

For most people, the local computer dealer is the best place to buy a printer. The computer store should stock all the supplies you need for your printer, including ribbons, daisywheels, special paper if needed, ink jet cartridges, and so on. If the establishment you are dealing with does not have these items, find another computer store.

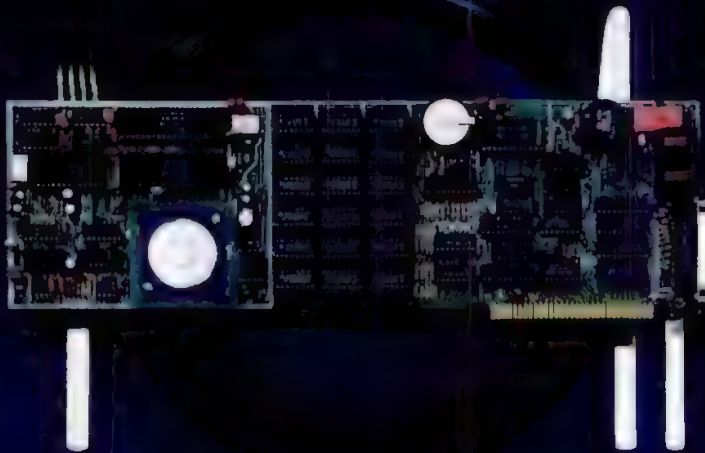
Likewise, dealers should be able to properly set up and service any printer they sell. Most good stores provide local service or at least have a contracted arrangement for factory service when required. Some may offer a loaner machine while repairing yours.

One indication of the level of service and support you can expect from a store is the salesperson who sells you the printer. If he or she appears knowledgeable about both the product and your printing needs, you can expect competent future support. If he or she seems to be pushing you toward something you don't want or need, say so and feel free to notify the manager or owner that you're unhappy.

In any event, take this issue of *PC* with you when you go shopping for a printer and use the charts as a guide to how the machines stack up against each other. With a little bit of advance thought and planning, you should be able to select a printer that will satisfy your needs for years to come. ■

MODEM À LA MODE

MODEM À LA CARTE



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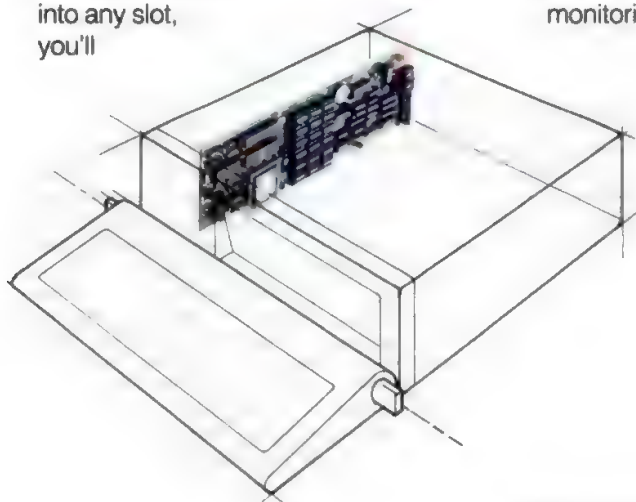
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DOT MATRIX PRINTERS:

Dot matrix printers are the traditional workhorses for PC users. Their low cost, speed, quietness, and flexibility have endeared them to a wide range of PC users. There are more dot matrix printers in use, and more of them made, than any other type of printer. PC tested a total of 167 matrix printers for this issue, far more than any other type of printer.

Matrix printers form characters and symbols from a series of tiny dots printed on paper, much as video-display characters are formed by a series of pixels. Most are impact models that use fine wires mounted in the printhead to strike the paper through a ribbon. The new ink jet printers "spray-paint" dots on the page, while older thermal designs use heat to burn dots onto specially treated paper.

Simple Mechanics

Dot matrix printers are inexpensive because they require a relatively small number of generally small moving parts. Impact models use small electromagnets and springs mounted in the printhead to move the wires; ink jet models open and close tiny electronic valves in their heads to spray ink; and thermal designs require no motion inside the printhead at all, only enough electricity to generate a small amount of heat.

Most matrix printers include only two motors, one to move the paper-feed mechanism and another to move the printhead back and forth across the paper's surface. The motors don't have to be large or powerful because the typically small and light printhead on a dot matrix printer doesn't

IN THIS SECTION

Less than \$800

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Legend 880
Centronics
GLP
Seikosha
GP-550 PC
Cal-Abco
Legend 1200
Okidata Corp.
Microline 82A
Personal Micro Computers
DMP-85
Smith Corona
D-100
Mannesmann Tally
Spirit-80
Star Micronics, Inc.
Gemini 10X
Epson America, Inc.
RX-80
IBM Entry Systems Division
PC Graphics Printer
Hewlett-Packard
Thinkjet
Diablo Systems, Inc.
P10 I
Panasonic
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Olympia
Electronic Compact NP
Inforunner
Riteman Blue Plus
Micro Peripherals Inc.
"S" printer
Epson America, Inc.
FX-80
Micro Peripherals Inc.
Printmate 99
Okidata Corp.
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Okidata Corp.
Microline 92 (Standard)
Dataproducts
SPG-8010-2

Facit Data Products
4511

Texas Instruments, Inc.
850
Diablo Systems, Inc.
P12
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H80
Practical Automation
8-PLP
Smith Corona
D300
Star Micronics, Inc.
Delta 15 PC
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8510SP

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Radix-10PC
NEC Information Systems
P2 Pinwriter
Siemens Comm Systems
PT-88
Texas Instruments, Inc.
855
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1550EP
Diablo Systems, Inc.
P32
Facit Data Products
4512
Toshiba America
P1340
Mannesmann Tally
MT-180
Okidata Corp.
Microline 84 (Standard)
Okidata Corp.
Microline 84 (Plug 'n' Play)
Micro Peripherals Inc.
PrintMate 150A
Genicom Corporation
3014

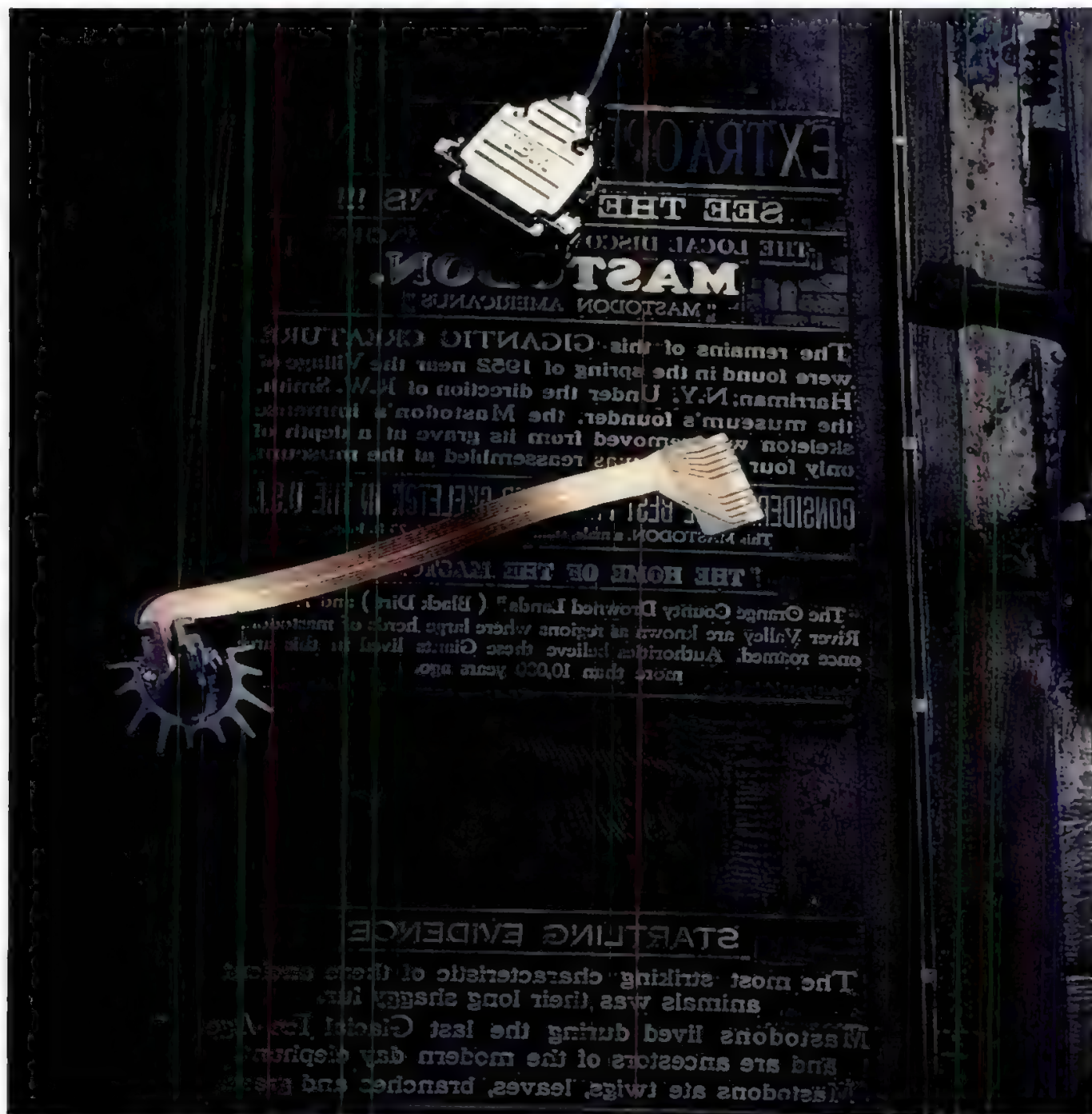
\$1,200 TO \$1,999

NEC Information Systems
P3 Pinwriter
Epson America, Inc.
LQ-1500
Printek
910
Digital Equipment Corp.
LA 210
Datasouth
DS 180
North Atlantic Qantex
7035
Toshiba America
P1351
Printek
930
Datasouth
DS 220
North Atlantic Qantex
7065
CIE Terminals
CI-3500 (Model 20)
Fujitsu America Inc.
DPL24
Comrex International, Inc.
ComRiter 420

\$2,000 AND UP

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Pacemark 2350
Printek
920
Okidata Corp.
Pacemark 2410
Mannesmann Tally
440L
Anadex
WP 6000
Printtronix
MVP 150C
Anadex
DP6500
Santec Corp.
Variflex S700
Florida Data
OSP 130
Newbury Data
Recording, Ltd.
DRI 8850

CHARACTER BUILDING



Photograph: Len Morvillo

need much force to push it around.

Short Trips

The primary source of a dot matrix printer's speed is the small distances the moving parts inside the printhead need to travel. All movement required to locate the dots on the page is made by sliding the head back and forth across the paper. The rest of the printing job is done by the magnets and springs. This allows the head-to-paper distance to be almost immeasurably small. Ink jet printers take advantage of the small distance to spray the ink both accurately and quickly.

The tininess of the wires, their short traveling distance, and the speed at which they impact the paper results in a low noise level but a high frequency (pitch), similar to the sound of a dentist's drill. Matrix printers are generally quieter than fully formed character printers, and the almost silent ink jet printers emit only a mild "clunk" when the printhead returns to the left margin.

Printing with Dots

The tiny size of the dot impact points makes matrix printers extremely flexible. Virtually any character or pattern can be created by various formations of dots. The dot patterns that make up characters are usually programmed into the machine's ROM chips by the printer's designers. Newer models let you program custom characters by "downloading" dot patterns to the printer—a boon to calligraphers who want to experiment with connect-the-dots style character design.

One of the newest options for dot matrix printers is interchangeable character fonts whose modular packaging smacks of home computer games. These cartridges give dot matrix printer users the same freedom of font choice that users of fully formed character printers have had for years.

The type size (pitch) of a dot matrix printer can be changed over a wide range through software control. No mechanical parts need to be changed, even when

moving from 5 characters per inch (cpi) to 17. This allows pitch changes to be made anywhere, including in the middle of a line.

Most of the dot matrix printers tested here offer a graphics capability. Popular software packages can use this feature to print graphs, charts, and pictures, with a quality similar to those made with a pen

The "dot matrix look" has long made users jealous of the prettier, "typewriter look" faces of fully formed character printers. But new matrix technology is remedying this.

plotter. The hackers among you can roll your own graphics in BASIC, C, or whatever language you prefer.

A majority of the dot matrix printer graphics facilities are compatible with the PC-DOS GRAPHICS.COM program for dumping color graphics screen displays to the printer. This makes hard-copy graphics a trivial chore for anyone with a color graphics screen. If the printer is not compatible, the printer vendor or a third party often supplies software to allow dumping screens.

Quality

The most common knock against dot matrix printers is the poor quality of their output. The "dot matrix look" has long

made users jealous of the prettier, "typewriter look" faces of fully formed character printers. Early attempts to remedy this situation by doubling the number of horizontal or vertical dots per character resulted only in fat-legged matrix characters, not typewriter quality printouts.

New technology has moved from these crude matrix-print enhancement techniques to correspondence quality printing that only the most discerning IBM Selectric fan could distinguish from the genuine article. Enhancements are generated by a combination of very high dot densities (achieved through more pins, more head passes, or a combination of the two) and new font designs that mimic those used by fully formed character printers and make the dots seem to disappear. An increasing number of matrix printers offer both high-quality printing and affordable prices.

The cost of matrix printers is now so low that you can get an entry-level matrix printer offering decent print quality and performance for as little as \$300—2 years ago that figure was \$500. Costs at the high end of the matrix-printer market have come down proportionally, but you can still go into hock trying to buy a state-of-the-art model.

The sheer number of matrix printers available makes for a fairly smooth curve of prices. As a result, when it came time to categorize the wide choice of matrix printers available, cost was chosen as the basis for grouping them.

Not surprisingly, the largest number (31) of matrix printers is in the low (up to \$800) end of the scale, and the smallest (10) in the high (over \$2,000) end. Check your wallet to see what category best suits your budget before reading the reviews and poring over the data in the table. Each price class has an ample selection. But don't hesitate to look further—you may find something that you can more easily afford that will fulfill your needs, or even decide you want to spend more than you had planned to obtain the printer of your dreams. ■

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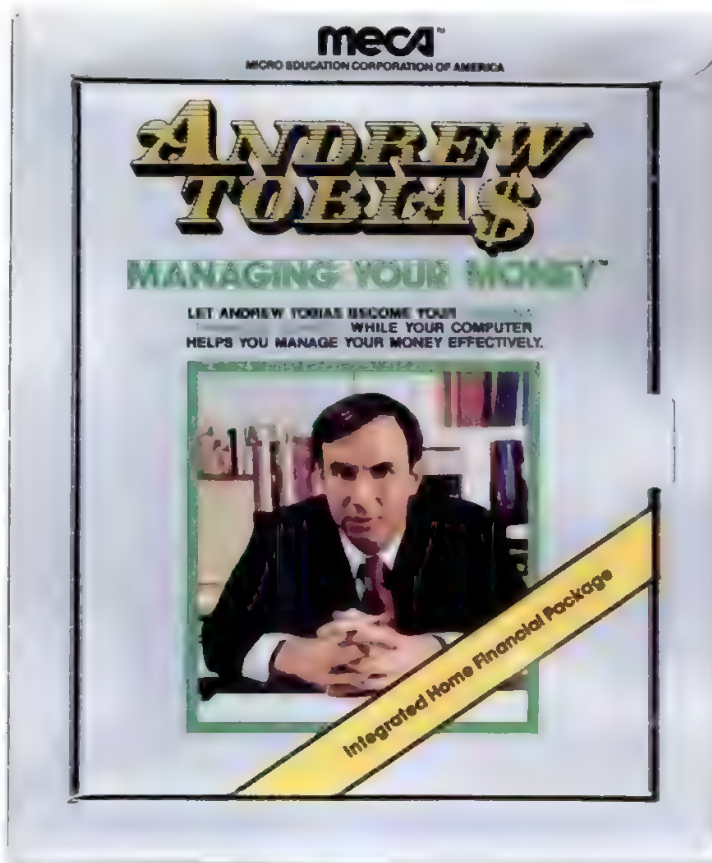
PERSONAL SOFTWARE MAGAZINE, JULY, 1984.

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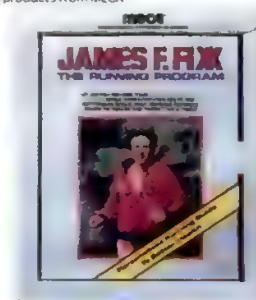
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CIRCLE 151 ON READER SERVICE CARD

Practical Automation 8-PLP

The 8-PLP dot matrix printer from a firm called Practical Automation could be a real sleeper in the less-than-\$800 category. It's a fast, relatively inexpensive and somewhat stripped-down, no-nonsense machine. It was clearly designed to cater to the needs of busy offices (it has an adjustable platen for printing through

forms with up to six copies), but it's no slouch as a fast data-output printer either. And furthermore, it's built right here in America by a firm that until recently specialized in manufacturing print heads for OEM applications.

Setting up the machine was quick and easy. It comes with a ribbon cartridge already installed (plus a spare), so you just remove a couple of shipping restraints, pull back a lever to load paper, and power up. Surprisingly, the machine's printing platen is not a roller. It's just a fixed,

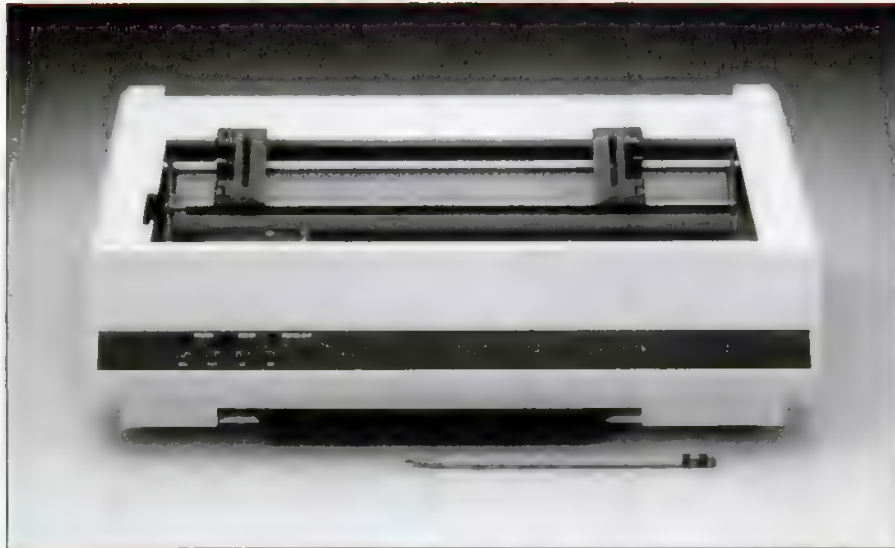
curved, metal form that the tractor mechanism pulls paper over. The lack of a roller means that you can't hand-feed sheets one at a time.

The paper loads quickly and easily, too, and the mechanism seems almost jam-proof, with both bottom and front paper-feed slots provided. You just push the paper into whichever slot you wish to use, and it slides right on past the platen. You catch it with your other hand and engage the holes on the tractor sprockets. That's all there is to it.

On initial power-up, all the proper LEDs lit up, and the feed functions seemed to work. When I tried to run the printer's built-in diagnostic character printout, however, I could hear it trying, and I could see the printhead racing back and forth, but not much was going onto the paper. A quick call to the manufacturer solved the problem. There's a lever that the instructions say you must pull back during setup, but unfortunately, they don't adequately explain what the lever is or why they want you to pull it back. It adjusts the platen pressure for when you want to print only a single thickness or to bear down hard for multipart forms. (You should use as little pressure as necessary. More just beats the machine unnecessarily, increases printhead temperatures, and shortens service life.)

I think the manual could have spelled that out a little better. The trouble-shooting section suggests only checking for a bad circuit board or printhead if the machine refuses to print the diagnostics. The adjustable platen pressure is a neat feature, though, for a machine designed for use with business forms of varying thicknesses.

The 8-PLP is a 7-bit machine rather than a full 8-bit printer, but, considering the market it's designed for, that should be adequate. All you lose is the ability to print the ASCII characters above 127. But you don't need anything up there to spell "Past Due" or "Please" or to let your accounts know you could get mean and nasty. For a business-oriented machine, the lack of



8-PLP
Practical Automation, Inc.
Trap Falls Rd.
P.O. Box 313
Shelton, CT 06484
(203) 929-5381

List Price: \$728

CIRCLE 778 ON READER SERVICE CARD

using the Power On Default feature(s).

higher-order characters is no real limitation.

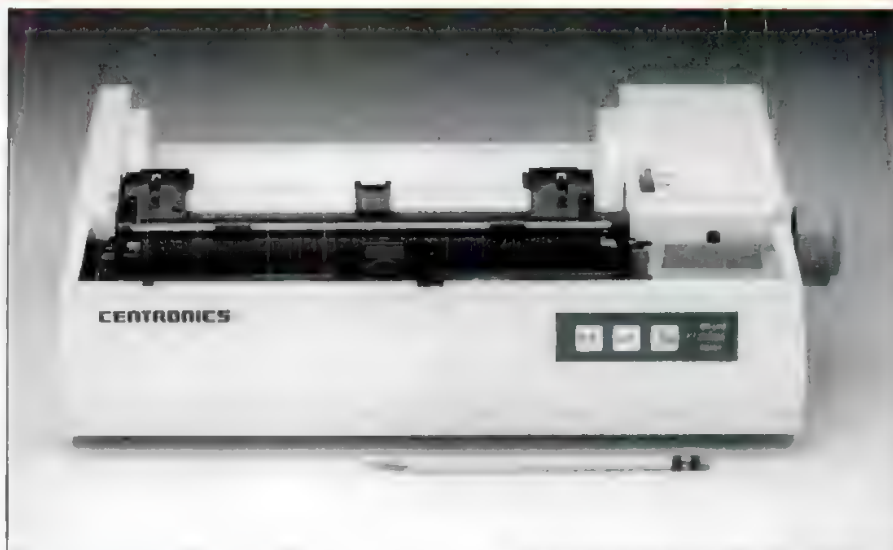
The 8-PLP isn't exactly loaded with extra features such as fancy type fonts or correspondence quality, but for the market it's designed to serve that really isn't any drawback either. It has a nice, clean 10-pitch character set that zips along at an honest 135 characters per second or better, according to our tests. And it has a nice-looking, 16.5-character-per-inch condensed mode for writing little notes, as well as a 5-cpi setting if you really want to get their attention or a 8.25-cpi pitch if you're only mildly annoyed. And, of course, you can download commands from either the keyboard or software to set horizontal and vertical tabs, line spacing, and other parameters for business forms anywhere from 3½ to 9½ inches wide and in various lengths.

While this printer isn't for everyone, if you've got a business that needs its special talents, you might do well to give it a look.—Jim Forney

Centronics H-80

The Centronics H-80 dot matrix printer comes out of the box ready to plug in and go to work, and that always starts me out in a good mood. It's especially important for printers in the low-to-moderate price range, where you know the dealer isn't going to send out a technician to help you get it up and running. The H-80 also comes with one of the better user manuals I've seen, with ample space devoted to explaining the functions of the various escape codes used to invoke the printer's special features. I actually caught myself smiling while reading it—well, almost anyway.

However, when it got to "show me" time, PC's tests found that a number of the codes did strange things. The code for subscripts gave oversize characters instead, and once the printer was put into condensed mode, I had to shut the machine off and let it run through its pow-



H-80

Centronics Data Computer Corp.
1 Wall St.
Hudson, NH 03051
(603) 883-0111
List Price: \$699

CIRCLE 753 ON READER SERVICE CARD

using the Power On Default feature(s).
using the letter quality feature(s).

er-up default to get it back to normal. A check of the DIP switch settings, and even a change in some of the default settings, did nothing to solve the problem.

A closer look at the manual revealed an alternate set of escape codes. The manual lists these codes along with samples of the results they're supposed to produce, but it doesn't explain them. These new codes worked flawlessly. It turned out that the H-80 has some nice enhancements and even prints italic characters!

For some reason, the ribbon kept giv-

ing me trouble while I was testing the H-80. It would get slack and sloppy, and the print would start looking scruffy. I'd occasionally use the little knob on the ribbon cartridge to tighten it, but the next thing I knew it would be loose and sloppy again. I took it out a couple of times to see if I could fix it, but the problem didn't go away. It was especially annoying when printing graphics.

I also had trouble with the location and operation of the on/off switch. I don't usually pick on on/off switches, but if the

machine goes berserk I don't want to fumble around for the power switch while it tries to self-destruct. And I didn't like the design of the flip-up cover over the tractor/platen, either. Not only did I find it inconvenient, but I felt it should have done a better job of keeping the noise down.

I did find a number of things I liked about the H-80, but not enough to make me wish I'd waited for it to come along before I put my hard-earned dollars on the counter for some other printer.

—Jim Forney

Cal-Abco Legend 1200

If imitation is the sincerest form of flattery, then Epson must be flattered indeed by all the MX-80 imitators it has spawned. The Cal-Abco Legend 1200 is just another one of them. Imitation means compatibility, so you know the Legend 1200 will work with software that works with the Epson MX-80. If that's what

you're looking for and you don't really want to pay much, Cal-Abco wants your business.

Personally, I would be more pleased to see printers compatible with the IBM Graphics Printer instead of the Epson. The Cal-Abco falls down in the PC compatibility test because it uses Epson italics rather than the special PC screen-graphics characters.

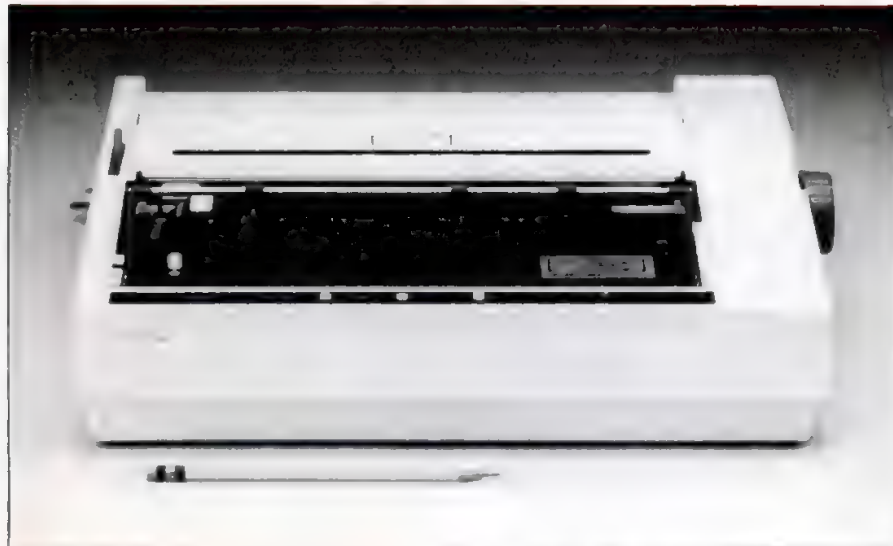
With a printer so slavishly imitative of the Epson, my attitude is, "Okay, manufacturer, you've saved a lot of money on research and technical development. Let's see how you've put the package together." In Cal-Abco's case, not very well. The construction is flimsy, and the printer tends to maul paper.

There are two top covers. The rear cover is hinged and removable; the front cover looks as if it should also be hinged, but there is nothing in the printer case to sit the notches on. The paper didn't seem to want to go through the two lids in the way it was supposed to, and it was less troublesome to run the printer with the covers removed.

The printer has a friction feed for single sheets and a tractor feed for fanfold paper. The platen is only 9 inches wide, however, so normal 9½-inch fanfold paper hangs over the edges. It's usable, but the paper makes crinkly sounds as it winds through the printer, as if it's about to come out of the tractor feeds. Sometimes it does, but the paper gets wrinkled on the edges, in any case.

The small and unexciting manual for the Legend 1200 tells you what you need to know about control sequences but not much more. The limited typefaces used in the manual make things difficult to find. The printer's typefaces will be familiar to users of the Epson or other Epson-compatible models. Epson control codes implement enlarged, compressed, italic, double-strike, emphasized, subscripts, superscripts, and underlined type styles. Except for italics, these codes are the same for the IBM Graphics Printer.

The Cal-Abco Legend 1200 is compat-



Legend 1200
Cal-Abco
Legend Peripheral Products
6041 Variel Ave.
Woodland Hills, CA 91367
(818) 704-9100
List Price: \$339

CIRCLE 739 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Double-strike feature(s).
using the Emphasized feature(s).
using the Double Strike + Emphasized feature(s)

ible with PC-DOS GRAPHICS, and it will print a black-and-white picture from the color-graphics display. It may leave some gaps in the finished product, but they are due to paper slippage and not software.

You can use proportional spacing, but external programming is required to use it in conjunction with right justification. The relative proportions of the different-size characters are not indicated in the manual, so you have to figure them out yourself.

The printer provides a hex dump mode to check on exactly what characters the PC sends to the printer. This feature will aid in debugging your own graphics programs for the Legend 1200.

The machine I tested did not have the Cal-Abco or Legend names on it. A back label identified the manufacturer as Copal, and the printer was labeled an SC-1200. A Cal-Abco spokesman told me I was testing a factory prototype and that the eventual production models with the Legend 1200 name will be a little different. I mentioned the paper-slippage problem, and he indicated they would have to "tighten some springs."

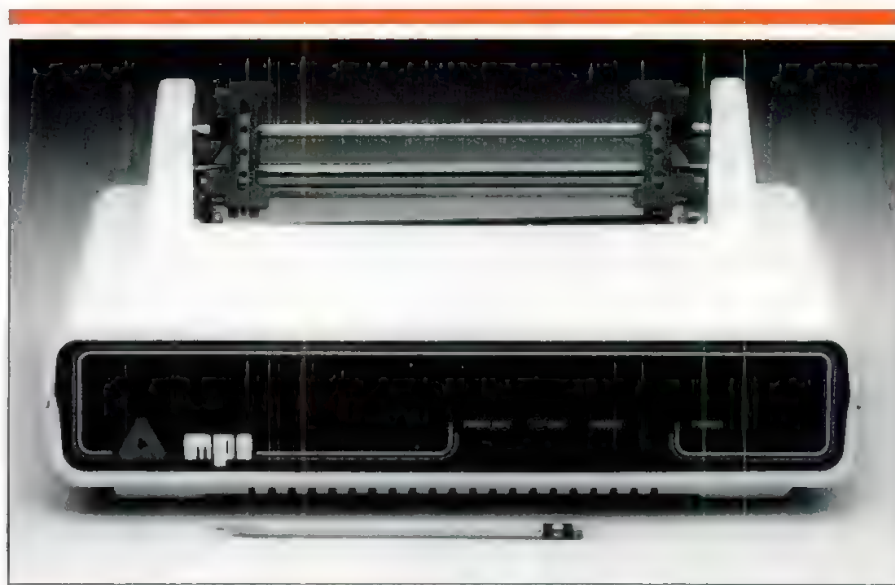
I hope the final product is better than the prototype. If Cal-Abco tightens those springs, lengthens the platen an inch, fixes the lid problem, and installs a PC graphics ROM, it might attain the status of a legitimate contender in the low-cost dot matrix printer market. Without these improvements, it's out of its league.

—Charles Petzold

Printmate 99

Dot matrix printers are supposed to have enough features to satisfy most needs as unobtrusively as possible. Unfortunately, Micro Peripherals's Printmate 99 is about as unobtrusive as the Invisible Man in Bermuda shorts at a formal gathering.

You'll first notice the Printmate's unfriendliness when you attempt to connect the interface cable. Both the serial and parallel ports are alongside the DIP



using Power On Default



Printmate 99

Micro Peripherals, Inc.
4426 S. Century Dr.
Salt Lake City, UT 84107
(800) 821-8848
List Price: \$599

CIRCLE 787 ON READER SERVICE CARD

switches—on the inside of the machine. In itself, this would be only a minor inconvenience, but the instructions for disassembling the printer and locating the ports are scattered throughout the documentation. Moreover, the Printmate offers only the most basic features: four pitches (from 5 to 17 cpi), an underline enhancement, variable form length (in inches), a graphics mode, and one alternate font.

Even after you have the printer up and running, you will encounter seemingly inexplicable design quirks. For example,

the Printmate 99 offers a fairly nice-looking serif font, but you cannot mix it with the standard typeface on the same line. Selecting the serif font causes the print-head to return to the leftmost position and begin printing from there. Even if you only want to switch fonts from one paragraph to another, you cannot. There is no documented escape code to turn off the serif font. The only way to get out of the serif font mode is to power down—a most undesirable alternative. The manufacturer does offer a program that will enable you



start and stop bits is presented in the same format as the instructions dealing with escape codes and setting up the printer. The effect is that both seem of equal importance. If you're just interested in printing out some text files, you'll have to read through a lot of unnecessary and at times highly technical information to get what you need.

All in all, the Printmate 99 does not give you performance worth its price, nor is it easy to use. It may do what the company claims, but it is definitely not worth your money or your time.

—Vincent Puglia

C. Itoh 8510SP

The C. Itoh 8510SP appears to be a fairly solid, medium-duty, wide-carriage dot matrix office printer. No quirks complicate the task of getting it up and running, and its decent, well-detailed manual helps quite a bit.

First impressions can be deceiving, however. Although the initial setup was relatively quick and uneventful, things began to slide downhill rapidly when I tried to make it do the special things it's supposed to do.

I tried 10 cpi, and I got 10 cpi. I tried 12 cpi and got 10 cpi again, and 5 cpi also gave me 10 cpi. Draft quality was draft quality, and so was everything else. Variable line feeds and reverse line feed were all stuck at six lines forward. I checked the DIP switches, and I carefully reread the manual, but to no avail.

So I called C. Itoh's technical support people in California. They assured me that the standardized test program *PC* used to test all the other printers in this issue was totally wrong. The C. Itoh technician then dictated new command sequences. Unfortunately, his instructions fixed only the command sequence for 5 cpi—everything else still refused to work. The printer wouldn't even take screen dumps of text gracefully.

As a result, I can't provide a full eval-

W a

C. Itoh 8510SP

C. Itoh Digital Products
1011 Francisco St.
Torrance, CA 90502
(800) 348-1984
(213) 327-5939
List Price: \$795

CIRCLE 765 ON READER SERVICE CARD

using the Power On Default feature(s).

to alternate between the two fonts, but it costs an additional \$39—after you have paid \$599 for a dot matrix printer that does not even have subscripts, superscripts, or proportional spacing.

The Printmate 99 is not compatible with PC graphics. When I attempted a graphics screen dump, the printer interpreted the graphics data as line feeds. For a while it was spewing out paper as if a ticker-tape parade were in progress and it were the sole spectator. The optional software package for alternating fonts is sup-

posed to provide complete PC graphics compatibility.

Documentation tends to be the weakest part of any computer product, and the 60-page manual for the Printmate is far from an exception. The problem is not a lack of illustrations or information but rather the poor organization and presentation. For one thing, the samples of the Printmate's serif font are not well reproduced; in places they look like the printer's draft mode instead. And in the section dealing with the serial interface, a discussion of

uation of this product, but my preliminary impression suggests that you should stay as far away from it as possible.

—Jim Forney

Smith Corona D100

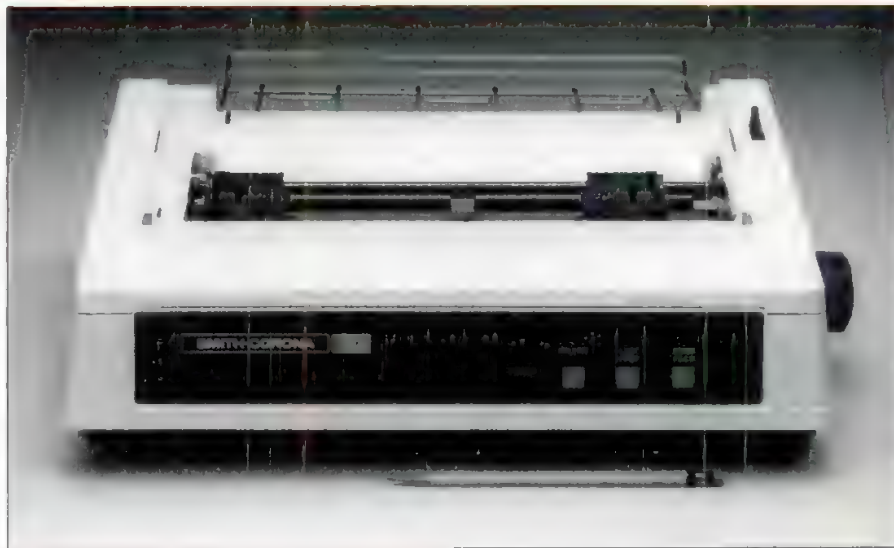
Like a man without a country, the Smith Corona D100 dot matrix printer may land in many different ports but will find a home in very few. This generic printer has enough features to make it rather interesting, but not enough to distinguish it from the hordes of other Epson-clones presently glutting the market.

The D100's lack of the high-order IBM character set, combined with its inability to dump PC graphics, mean that it is not completely PC-compatible. In today's world, where hard copy of spreadsheet graphs is de rigeur, even the inability to use the shift-PrtSc feature is quite a drawback.

Interestingly, the printer's graphic abilities closely resemble those of the IBM PC. Its graphics-test results were just about equal to those that can be produced by the IBM Color Printer: a horizontal band of blank space runs across every few centimeters of the image. However, while IBM is in the process of supplying a patch, SCM is not.

The documentation also leaves much to be desired. Although it supplies useful tables and explanations of the available features, it doesn't look out for the needs of novices. For example, it fails to explain how to find the top of a form and doesn't provide samples of the print enhancements. Worse, the illustration for ribbon insertion is completely useless. The perspective makes it almost impossible to discern the tractor, let alone the ribbon guides the illustration is supposed to display. And this is from a company that manufactures typewriters!

Of course, the D100 is not completely without graces. It offers two fonts (standard and italic) and a slew of enhance-



D100

SCM Corp.

3695 Erie Boulevard East

DeWitt, NY 13214

(800) 448-1018

(800) 962-3000 in New York

List Price: \$395

CIRCLE 784 ON READER SERVICE CARD

using the Power On Default feature(s).

using the condensed, emphasized mode feature(s).

ments, including condensed, compressed, and elongated print. It even provides for proportional spacing, a nice feature for users interested in producing form letters. The usual tab settings, backspace, underline, superscript, and subscript features are all present as well.

Some other nice touches include the easily accessible DIP switches, located alongside the parallel port. Their functions include setting the column length (80 or 132), the zero font (slashed or not), automatic line feed with a carriage return, and

the print mode at power-on (normal or emphasized). Also, depressing both the line-feed and form-feed switches during power up obtains a hex dump of all input data.

Still, plenty of dot matrix printers offer comparable features for less than the D100's \$395 list price. Apart from the fact that its corporate name is familiar, the Smith Corona D100 thus falls into the Brand X category of dot matrix printers: it won't bowl you over, but it does work.

—Vincent Puglia

Riteman Blue Plus

The Riteman Blue Plus Printer looks like Mr. Right. He's handsome, trim (a compact 9½ inches wide), and his big blue logo perfectly complements my IBM. The stars in my eyes turned to glints of suspicion, however, as his seamier vital statistics were revealed to me.

I can never trust a piece of equipment that markets itself by one-upping the com-

petition. By the time I'd finished reading Riteman's literature, I wasn't sure if I was reading about Riteman or about everything that was wrong with the other guy—namely, the Epson. Real men stand on their own merits!

Inforunner's Riteman Blue Plus has an incredible list of attributes. It claims 128 different text modes. It has a full range of print sizes from normal expanded (5 cpi) through compressed (17 cpi), a full 96-character ASCII set, italic characters, IBM block graphic characters, and eight

international character sets. It can print in standard, double-strike, or emphasized modes. It underlines, does subscripts and superscripts, and there's even a micro-mini print mode for those who enjoy squinting at fine print. Riteman's elite mode produces a near-letter quality print that is significantly better than those offered by most correspondence quality modes.

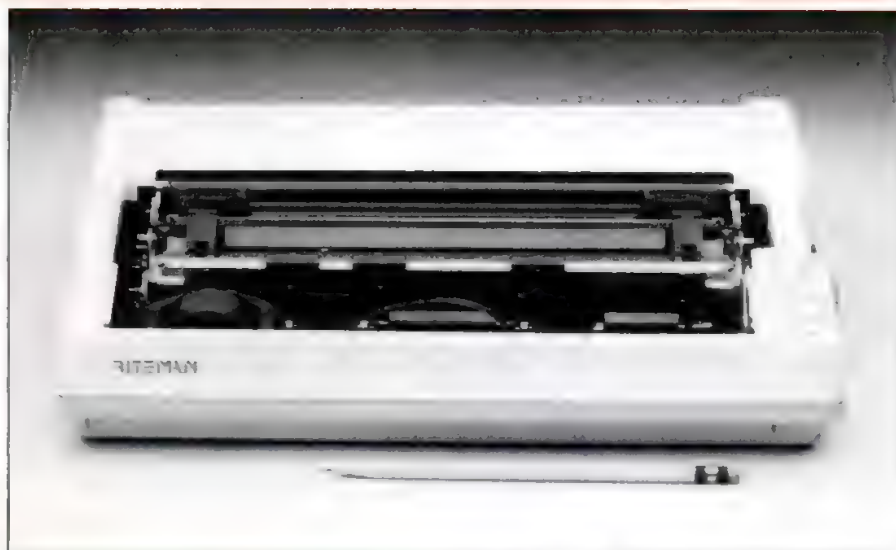
I'm a sucker for a good-looking printer, and Inforunner's Riteman sports clean trim lines on the outside and an orderly high-tech appearance under the hood. Weighing in at 11 pounds, the printer isn't exactly portable, but in a pinch it could be tucked away in a large briefcase and carried under one's arm. Its 1-year warranty makes the 90-day industry standard seem pitiful.

Reading the documentation, especially those sections on software commands, was a pleasure. Each command was highlighted and clearly described, and the proper codes were given—a far cry from the mysterious documentation that accompanies most printers.

Riteman does have a good side, but it's not quite as good as the manufacturer would have us believe. For example, the manufacturer rates the Riteman Blue Plus at a speedy 140 cps. Our tests gave it a very respectable 76 cps. It's advertised as having a "low acoustic noise level," but at 88 dB it was one of our loudest printers. A second platen knob, or a form-feeder lever on the left side of the carriage, would eliminate having to stretch across the printer to reset paper. The pin-feed and paper-separator mechanisms for fanfold paper were also a nuisance. I pushed and shoved at the paper repeatedly and was never satisfied with its feed.

The Riteman Blue Plus is out to capture a chunk of Epson's domain. Specifically, it pits itself against the Epson RX-80. Riteman's quality is superior to many heftier printers, including the RX-80, but it's not superior enough to warrant its \$499 price tag.

Inforunner's Riteman is yet another



Riteman Blue Plus
Inforunner Corp.
431 North Oak St.
Inglewood, CA 90302
(800) 824-3044
(800) 421-2551 in California
List Price: \$499

CIRCLE 747 ON READER SERVICE CARD

using the Power On Default feature(s).
using the bold feature(s).
using the double strike bold feature(s).

product that takes advantage of the alleged "we will spend more" mentality of the PC user. It's a good printer—but I'll get on line for Mr. Riteman only when Inforunner starts knocking the price down and quits knocking the competition.

—Robin Raskin

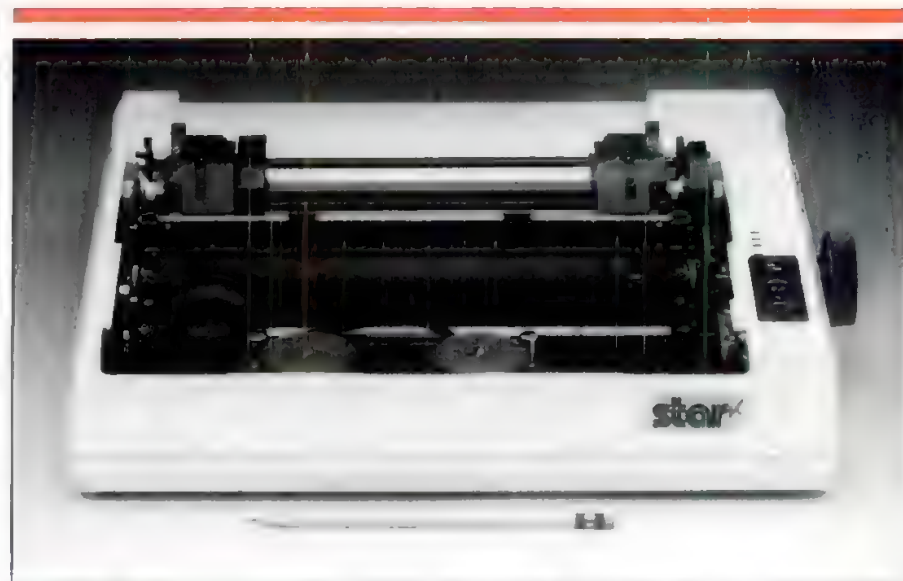
Star Gemini 10X

Having been brought up to believe that if you can't say something nice, you should say nothing at all puts me in a difficult position in reviewing the Star Gemini 10X printer. The Gemini 10X is the kind of flawed equipment that gives printers a bad name, and from the moment I unpacked it, I was unhappy with it.

The plastic cover that is supposed to help deaden the sound was broken in shipment. This fact might easily be overlooked if I hadn't discovered that this is a common experience among the users of this printer whom I talked to. Apparently Star's protective packing is less than effective, and the odds of getting an intact printer are much lower than you would normally expect.

Setting up the Gemini 10X is another problem, owing largely to one of the weaker manuals I've seen. The manual looks as though it were printed on a daisywheel printer, then reduced to a size appropriate for the fine print in legal documents. The few illustrations included are often quite poor. For example, the illustrations and instructions for loading paper in this machine are so bad that they could only be understood by someone who can already perform the task.

Another drawback of this printer is the spool-based ribbon. Spools are both clumsy and messy, and I see no excuse for using them. In this case, the problem is aggravated because the paper tends to pull the ribbon out of the guide (at least on the test machine), even when I took pains to adjust the machine for the proper paper thickness. When the ribbon wasn't actually being pulled out of the guide, it tended



wa

Gemini 10X

Star Micronics, Inc.
200 Park Ave., Suite 2309
New York, NY 10166
(212) 968-6770
List Price: \$399

CIRCLE 693 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Double strike feature(s).
using the Emphsized printing feature(s).
using the Correspondence quality (double/emph)

to be pulled up so that the printer lost the descenders of such letters as *g* and *p*, as well as underlining. At least the way to thread the ribbon is illustrated adequately in the manual.

The problems don't stop after you get this printer set up. For example, according to the manual, you can use either of two different control sequences to implement printing at 10 cpi. Although both sequences are supposed to be equivalent, I found that one command will change the pitch from 12 to 10 cpi, while the other is

needed to switch between condensed printing and 10 cpi.

The quality of the output also leaves something to be desired. Granted, I expect to sacrifice some quality with an inexpensive matrix printer, but there are limits. This one goes beyond those limits. The poor quality of the graphics output, for example, renders the graphics feature useless, and the highest quality of text output is only marginal for any serious use.

This printer really has nothing to recommend it. —M. David Stone

Diablo P10 I

I'm from the old dog/new tricks school of printer users, so I was skeptical about Diablo's entry into the dot matrix printer market. Diablo is a well-respected entity in the daisywheel printer jungle, but the P10 I and its more expensive brother, the P12, are the company's first dot matrix models. Though the P10 I has some short-

comings, its competitive price is certain to create a niche for Diablo in the low end of the matrix printer market.

The P10 I's flaws are minor, and many can be attributed to its neophyte status. I sensed that my review model was something of a trial balloon and subsequent refinements to the design were likely.

The manual was stamped "Preliminary," and that was a gross understatement. Containing only a poorly photocopied list of escape sequences, it should

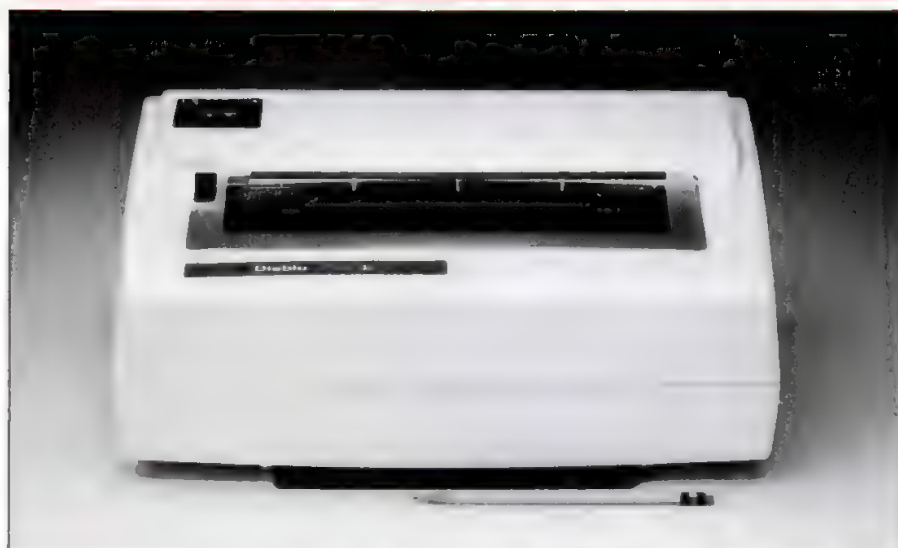
have been stamped "Not for Public Display." I shuddered to think that the print quality of the manual might be indicative of that of the printer itself. Calls to Diablo dispelled some of my fears, however, since they promised that a finished manual would be ready shortly.

While the printer felt substantial and well built (all 20 pounds of it), opening the dust cover (alias noise cover) and peering inside left me a bit skeptical about Diablo's attention to workmanship. Instead of a ribbon or neatly wrapped wires, exposed bright orange wires meandered around the perimeter of the printer's innards. The Power On button is awkwardly placed in the rear of the printer's underbelly.

The adjustable tractor feed can accommodate a respectable variety of paper widths and lengths. The printer takes standard fanfold paper through its rear-insertion feeder. Single sheets of paper can be inserted through a front slot without disengaging the rear fanfold sheets—a handy convenience for those occasional letterheads.

While both the single-sheet and fanfold mechanisms worked without a hitch, the paper's route once it exited the platen was less than desirable. The paper seemed doggedly determined to feed in on itself through the rear insertion slot, jamming up the works. Diablo could easily alleviate this annoying problem with a simple paper separator.

Retailing for \$499, the Diablo P10 I is the company's low-end dot matrix printer. With no alarm bells, no snazzy whistles, and only the minimum of control-panel lights and switches, it's obvious the P10 I is Diablo's economy model. It is the same size as the higher-priced P12, but the P12 supports a letter quality correspondence mode and is supposed to be significantly faster than the P10 I (actually, it isn't). The P10 I's print quality was impeccable, however, with fully formed, sharp images even in draft mode. While it won't win any prizes for speed or noise level—we measured it at 63.9 characters per second and 78 dB—it is capable of doing a pro-



P10 I

Diablo Systems, Inc.
901 Page Ave.
P.O. Box 530
Fremont, CA 94537
(415) 498-0000
List Price: \$499

CIRCLE 780 ON READER SERVICE CARD

using the Power On Default feature(s).
using the EMPHASIZED MODE feature(s).

ductive day's work without puncturing your eardrums. The emphasized double-strike mode, although painfully slow (18.3 cps), yielded spectacular print quality that is well worth the wait.

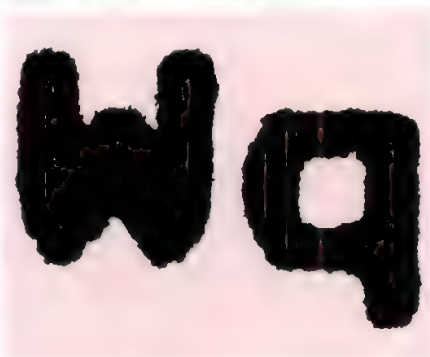
The graphics were perfectly IBM compatible. You'd be hard pressed to find better graphics capabilities for the price. In addition to graphics, downloaded characters can be defined through the use of FX-80-compatible standards. The printer also supports underlining, superscripts, and subscripts. It offers a full range of pitches, including wide (5.6 and 8.5 cpi), pica (10 cpi), elite (12 cpi), and compressed (16.6 cpi).

Diablo clearly has its eyes turned toward the international market. Manufactured in Italy, the P10 I has seven international character sets. I couldn't test them because of lack of documentation, but, in theory, you could set the DIP switches or evoke escape commands to enable a foreign character set on a permanent basis. Another touch of international savvy is that the printer accommodates both 11-inch (United States) or 12-inch (European) form lengths.

Diablo is still a babe in the dot matrix woods, but the P10 I is a good deal of printer for the money. Don't overlook it when you're about to make the big decision!—Robin Raskin

Epson RX-80

One look at the output of the Epson RX-80 printer and I nearly burst into my rendition of "I've Grown Accustomed to Your Face." Epson output is now so familiar it's difficult to judge it objectively. Nevertheless, while Epson's dot matrix printer produces perfectly adequate print quality, it's a far cry from the best that a dot matrix can offer. In its standard mode, the Epson RX-80 sports a "dot matrixy" appearance, where the dots are too small and too far apart. Nonetheless, printers are not judged by dots alone, and in this case the price versus performance



RX-80

Epson America, Inc.
3415 Kahiwa St.
Torrance, CA 90505
(213) 539-9140
List Price: \$399

CIRCLE 711 ON READER SERVICE CARD

using the Power On Default feature(s).

using the emphasized feature(s).

using the double strike emphasized feature(s).

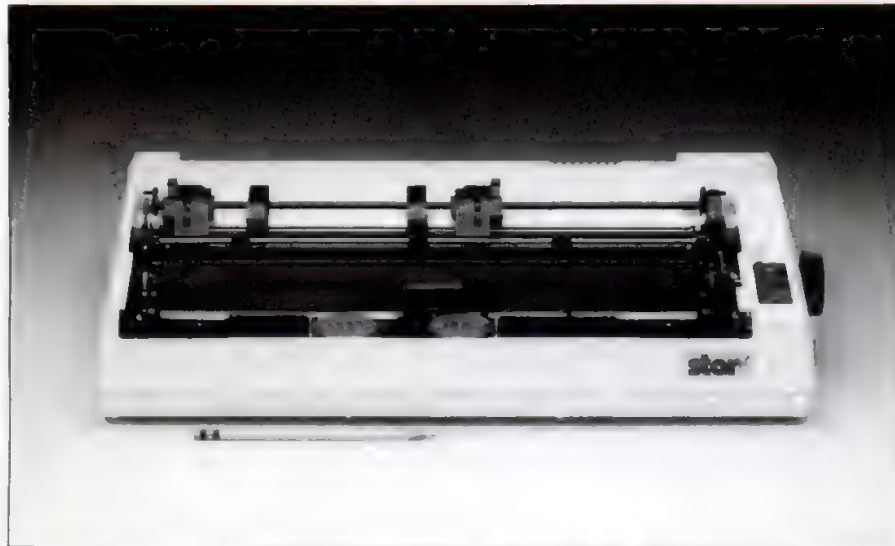
equation works out in the Epson RX-80's favor.

In a world where printers are notorious for gobbling up paper and being impossible to assemble, the Epson RX-80 is refreshingly simple to operate because it has adopted the FT combination roller/tractor/pinfeed system already proven on the MX series. I, who am capable of jamming the paper in a looseleaf notebook, could not make this paper feed misbehave. Moreover, in the amount of time I spent figuring out how to uncrate other printers,

I was able to quickly assemble the Epson and begin printing.

I did not enjoy my run-in with Epson's DIP switches. I understand that DIP switches should be difficult to trip accidentally, but these are ridiculously embedded inside the case, requiring too much excavation for my tastes.

Contrary to the company's claims, the Epson is not 100 percent compatible with the IBM Graphics Printer. The fundamental difference is that the Epson RX-80 has a text mode that contains only PC-compat-



Wq



Delta 15 PC

Star Micronics, Inc.
200 Park Ave., Suite 2309
New York, NY 10166
(212) 557-6440
List Price: \$795

CIRCLE 755 ON READER SERVICE CARD

using the Power On Default feature(s).
using the double-strike feature(s).

ible low-order (normal) characters. Epson's high-order (alternate) characters are italics, while the IBM Graphics Printer's are a mix of international and graphics characters. The Epson printer does do an admirable job of printing the PC's screen dumps using the DOS 2.0/2.1 GRAPHICS command.

Epson's superb manual carefully and uniformly explains the RX-80's programmable features, including a full series of pitches, pica, elite, condensed, double width, double strike, emphasized, sub-

scripts, superscript, and underlinings. The double-strike emphasized mode offers a reasonable correspondence quality print.

Even if it's not the highest quality around, the Epson look is accepted as a standard. And, at 50 cps in its standard mode, the Epson RX-80 offers reasonably speedy service. Furthermore, the Epson accessories are so common, they'll probably be available in supermarkets soon. For \$399, the RX-80 is a "safe," moderately priced answer to the printing dilemma.

—Robin Raskin

Star Micronics Delta 15 PC

Versatility, speed, and reliability make the dot matrix Delta 15 PC well suited for home offices. On the other hand, its use of standard typewriter spool ribbons and its somewhat fragile physical appearance suggest that it might melt down in a heavy data processing environment.

The manufacturer rates the Delta's speed in draft mode at 160 cps, but PC's benchmark test produced 110.6 cps. Although there is no correspondence mode, using double strike produced more than acceptable correspondence quality at 37.9 cps.

The Delta 15 PC is loaded with features. It has both a bottom and a rear feeder, both RS-232 serial and Centronics parallel interfaces, and supports an extremely wide variety of type pitches and fonts. These include double-strike and emphasized modes, superscripts, subscripts, and italics. Bit-image graphics at a resolution of 240 × 144 dots per inch are offered, but when I attempted to access the graphics mode using the PC-DOS GRAPHICS facility, the system locked and I had to reboot.

Other minor gremlins lurked in the command and escape sequences. After I accessed the condensed-print mode, Esc-P wouldn't return me to 10 cpi; the Delta 15 PC continued to hum along at 17.5 cpi. But using CHR\$(18), also a road into 10 cpi printing, worked. I encountered a similar problem when I tried to exit the double-width mode using CHR\$(20), but, in this case, Esc-W-O worked fine. The documentation, not the printer, seemed to be at the root of the problem.

All in all, the Delta 15 PC does most of what it's supposed to do. Personally, however, I prefer the Delta's kid brother, the Gemini 15X. It matches the Delta feature for feature, except that its rated top speed is only 120 cps. For \$250 less, it may be worth the wait. —Gary Markman

Smith Corona D300

Some printers resemble slick magazines, with color and plenty of features; others are more like pulp publications with garish covers and no substance. The Smith Corona D300 is more like a middle-of-the-road daily newspaper—extremely useful, but unobtrusive even when in use.

The D300 offers two fonts (standard and italic) and a slew of enhancements to choose from, including condensed, compressed, and elongated print—even proportional spacing. It also has the usual tab settings, backspace, underline, superscript, and subscript features. Its print speed was tested at just under 108 cps, and its noise level was lower than that of many comparable printers.

The D300 has other helpful touches, too. It offers a bidirectional tractor feed, bottom or rear paper feed, and easily accessible DIP switches. The DIP switches set the column length (80 or 132), the word length (7 or 8 bits), the parity, the baud rate or interface, the protocol, the zero font (slashed or not), automatic line feed with a carriage return, and the print mode at power-on (normal or emphasized). You can print all input in hex code simply by depressing both the line-feed and form-feed switches during the power-up procedure.

The D300's graphics abilities closely resemble those of the IBM PC Graphics Printer. *PC*'s test revealed that the D300 prints an almost exact duplicate of the screen, marred only by a very narrow horizontal band of empty space every so often.

The documentation supplies sufficient tables, along with some explanation of the available features. Unfortunately, it reads quite poorly. Perhaps it's the blueprint or the layout, but everything seems too busy. And that's just the beginning of its problems. The manual also has other common faults. Some of the illustrations are no more useful than a sieve in a flooded row-

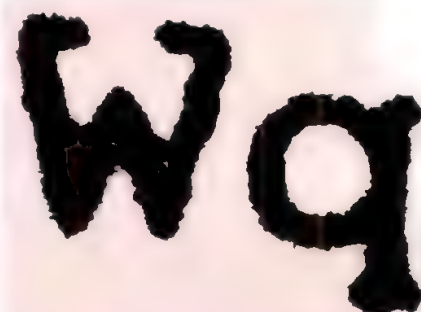
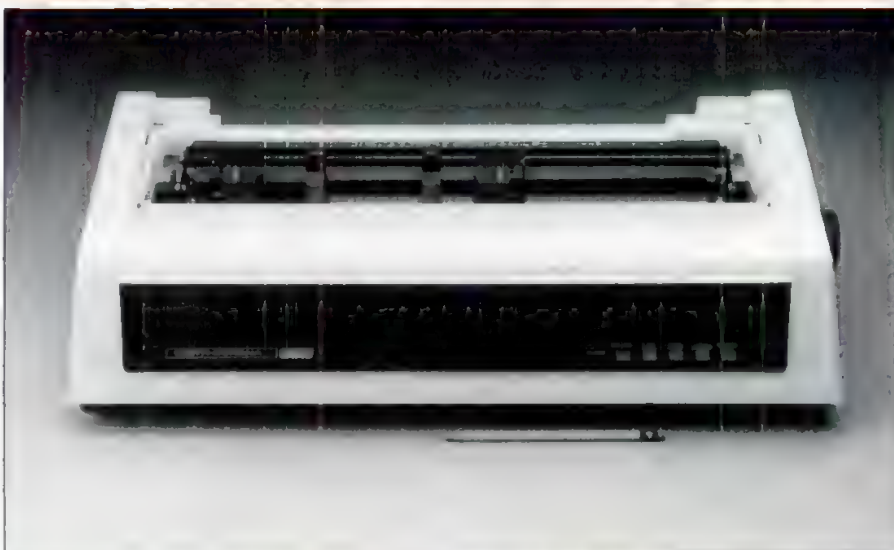
boat. Others condescend to the reader: Who needs an illustration to show them that paper should not be fed into the printer at an angle? If the manufacturer were so concerned about that possibility, shouldn't it have included a paper guide?

Fortunately, the Smith Corona D300 overcomes the drawback of its manual with an abundance of features, fast printing, and a reasonable \$795 price tag. Most of all, though, it quietly does what a printer is supposed to do—without imposing itself on you. —Vincent Puglia

Epson FX-80

A friend of mine who used to own an Epson FX-80 insists on calling this printer a dog. The fact is, Epson manufactures some printers that deserve praise and some that don't. The FX-80 falls into the second category, and I would have happily passed up the chance to play with it for this review.

Actually, "play with" isn't exactly the



D300

SCM Corporation
3695 Erie Blvd. East
DeWitt, NY 13214
(800) 448-1018
(800) 962-3000 in New York
List Price: \$795

CIRCLE 703 ON READER SERVICE CARD

printer using the Power On Default feature(s).

right phrase. "Struggle with" is closer, and "fight with" truly captures the spirit of my feelings toward using this ill-conceived machine.

The FX-80 is a noisy, somewhat difficult-to-use printer that produces barely readable, less-than-draft-quality output at a measured 62.7 characters per second. It also produces less-than-correspondence-quality output at a measured 43.1 cps. The bottom line is that, at any speed, it produces nothing that I consider readable.

But print quality isn't the only deficiency of this machine. Setting up the FX-80 is reasonably easy, but problems set in when you try to load paper (of all things). There is nothing I can say about this problem that the manual doesn't say better. This is a direct quote:

"Don't get discouraged—it takes a little practice to get the paper loaded right. The pin feeders must be set to just the right width or the paper will jam . . . If desperation sets in, try folding the first sheet over the second and feeding them through

together (thicker paper feeds a little better). With a little practice, you will feed the paper through smoothly every time."

Once I got the paper loaded (on the eighth try, and then only with someone's help), I was afraid to let it run out.

It may well be true that I could learn to "feed the paper through smoothly every time," but why should I have to?

Finally, there is the FX-80 manual. More than 300 pages long, it is chock-full of information about printers. At least one individual, whose opinion I respect, claims that this is the best manual around for anyone who really wants to learn about printers. On the other hand, it's longer than I would want to bother with, and I suspect that most people will feel the same way. Call it a hacker's delight, and let it go at that.

Even if you want an encyclopedia for a manual, you probably don't want to pay \$600 for it, and I can find little else to recommend the FX-80.

—M. David Stone



Wq



FX-80

Epson America
2780 Lomita Blvd.
Torrance, CA 90505
(213) 539-9140

List Price: \$599

CIRCLE 682 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Emphasized mode feature(s).
using the Double strike feature(s).
using the double strike/emphasized feature(s).

Legend 880

When I first got this printer from Cal Abco to review, I was disappointed before I even plugged it in. It came with no documentation, and the plastic lid was obviously for a different model that's about a half-inch wider. The film ribbon cartridge installed in the printer had been used. I overcame my initial disappointment, though, and spent some time with the machine to see what it had to offer.

I examined the print quality, which was somewhat light (probably because of the used ribbon) but very clean. I loaded the paper, testing the way the printer handled different sizes and types. And I tried to print a graphics display from the IBM color/graphics monitor. What was at first a tedious exercise soon turned out to be a very frustrating one as well. My initial disappointment came surging back.

Why? What I thought was the Legend

880 was actually one of Cal-Abco's discontinued Legend 800 models. Cal-Abco told me this particular machine, after lying abandoned in the warehouse, was apparently sent by mistake. The company then sent me a real Legend 880.

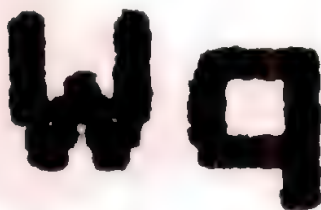
The 880 came with a manual, a cover that fit, and a brand new ribbon. I felt better, but not for long. This time the printer—the real 880—just wouldn't work. Whenever I tried to print something, the printhead would make a few passes back and forth, and then the machine would go off line. Disappointment is a poor description of how I felt at this point.

What can I tell you about the Legend 880? Cal-Abco told me that it's much better than the 800, which I found to be a good, inexpensive machine. The 880 *did* look like the 800; the similarities make me confident that a *working* model of the 880 would be a good buy.

Here are some of the details about the 800 that lead me to that conclusion. Unlike inexpensive dot matrix printers that print very noticeable dots or blurry, smudged type, the Legend 800's dots appear less obtrusive than most. The Legend series uses what Cal-Abco calls "square dot technology," which produces a nice effect. The characters are smaller than usual, and the results look good.

The printers in the Legend series are compatible with those of Epson rather than IBM. Instead of the special IBM display graphics characters, you get an italics set. The 800 responded to all of the most frequently used control sequences familiar to users of Epson and IBM graphics printers. But it could not print a graphics display from the IBM color/graphics monitor; it left thin gaps between each successive pass of the printhead.

The paper tractors are simple in design and sturdy. The paper loaded easily, and the 800 didn't maul it as Cal-Abco's Legend 1200 model had. Even though the platen was only 9 inches wide (fanfold paper hangs over it), the paper stayed wrinkle-free around the edges, again unlike it did with the Legend 1200 I tested.



Legend 880

Cal-Abco
6041 Variel Ave.
Woodland Hills, CA 91367
(818) 704-9100
List Price: \$279

CIRCLE 690 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Emphasized feature(s).
using the Double Strike feature(s).
using the Emphasized + Double Strike feature(s).

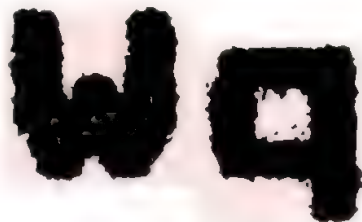
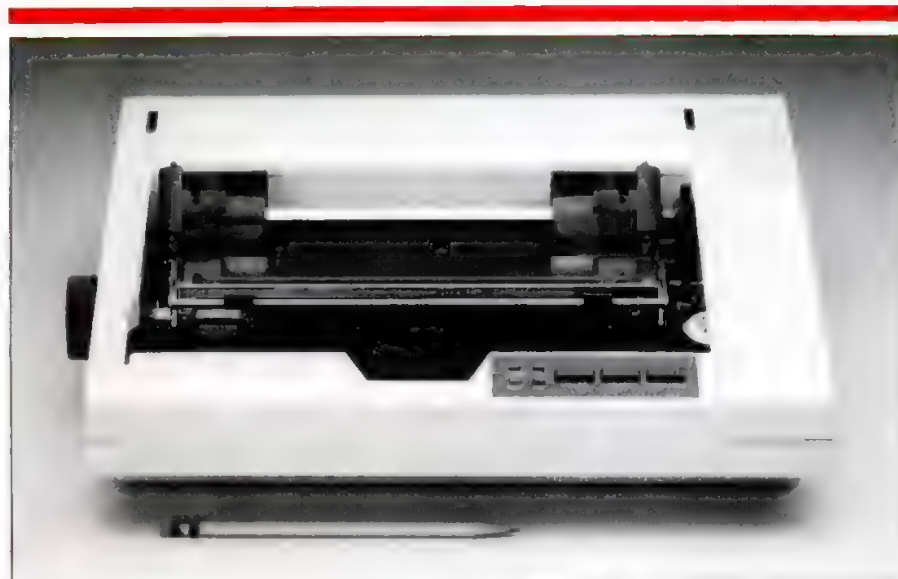
You can also print on single sheets of paper. All in all, if you're willing to forego the special IBM characters and graphics printing, the discontinued 800 is (or I should say was) worth your consideration. On the basis of that assessment, I'd say the 880 should be too.

As for the problems with Cal-Abco—sending first the wrong machine and then one that didn't work—what can you do? I know they've been busy lately, after moving to a new location, but they'll have to try harder. With all the printer companies

on the market vying for your attention, you should at least expect one that in return can give some attention to your needs. —Charles Petzold

Mannesmann Tally Spirit-80

The Mannesmann Tally Spirit-80 is a basic \$399 dot matrix printer. Small, light, and Epson MX-80 compatible, it makes a reasonable low-cost replacement

**Spirit-80**

Mannesmann Tally
8301 South 180th St.
Kent, WA 98032
(206) 251-5524

List Price: \$399

CIRCLE 790 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Double Strike feature(s).

using the Emphasized feature(s).

using the Double Strike & Emphasized feature(s).

for IBM's official dot matrix printers.

If you need only a small, inexpensive machine for printing normal characters and you don't want to change your existing Epson MX-80-compatible program, then this printer may be the one for you. But watch out—if you need to print the special IBM screen graphics characters or expect to print displays from the color graphics monitor, you may be in for serious problems.

The "plug-it-in-and-go" Spirit-80 is easy to install and operate. All you do is

remove the two holding screws from the bottom and place a wire paper guide in back. It has two clips to hold the paper next to the tractor feed, and a lever to control the paper release. It practically forces you to thread the paper correctly.

The Spirit-80 is small—barely wider than the paper it prints on—and portable—it fits under your arm. In addition, the front panel has the familiar three buttons (on-line, form feed, and line feed) and four lights (power, ready, on-line, and out of paper). Because the platen is solid,

it accommodates single sheets of paper under 8½ inches wide as well as 9½-inch fanfold paper. The right-hand tractor feed adjusts for the narrower paper.

Users familiar with Epson and IBM dot matrix printers will recognize the Spirit-80's print varieties, including elongated, compressed, elongated with compressed, double strike, emphasized, underline, and subscripts. If your word processing package lacks a Spirit-80 option, the Epson MX-80 configuration, found in most packages, works with no problem at all.

Two compatibility problems remain, however. First, consistent with the Epson, the Spirit-80 supplies an italic alphabet instead of the IBM screen graphics characters. This is inconvenient because many programs for the IBM PC use these special characters for screen display. So if you print a screen containing these characters, the Spirit-80 prints italic letters and numbers instead.

The second problem comes up when printing a graphics display from the color graphics monitor. PC-DOS 2.0's Graphics program includes an extension to the normal PC Print Screen routine that reproduces a graphics display on the IBM printer. This works on the Spirit-80, but with a hitch. After every pass of the printhead, it skips a thin blank line. This common problem probably could be fixed with a patch to the Graphics program, but the patch should have been supplied.

Remember that \$399 doesn't generally buy you a deluxe printer. For example, the Spirit-80's plastic top functions more like a dust cover than a hinged lid, and it has a tendency to fall while you're trying to change the ribbon. And, most peculiarly, the printer has only one external platen roller knob, and it's on the left side. I think it would make more sense to have it on the right. I don't know—maybe the Spirit-80 was designed by a southpaw.

The Spirit-80 has a few serious limitations, but if all you need is a competent, inexpensive, and easy-to-use printer, you may not have to look any further than this one.—**Charles Petzold**

Okidata Microline 82A

The Okidata Microline 82A is a poor relation in the Okidata printer family. Not as fast, versatile, or modern as the Microline 92/93 series, the 82A's low \$349 list price and Oki's reputation for ruggedness are its chief virtues.

The 82A is the 80-column, 9½-inch carriage version of the 82/83 series. It comes with both parallel and 1200-baud serial connections, a fixed-width pin feed (an adjustable tractor costs \$50 extra), and a speed rating of 120 cps. In PC's tests, the 82A managed 80 cps, about 10 percent slower than the 92/93 series.

Okidata offers a Plug 'n' Play option for \$39.95. This set of two ROM chips makes the 82A better able to understand IBM PC functions such as character and line pitch. The chips must be inserted into the circuit board in the back of the printer. (They're not in a ROM cartridge as in home video games.) It takes about 5 minutes to install them. No radical surgery is called for, but if you have any qualms, have your dealer do it.

While Plug 'n' Play for the 92/93 series Okidata printers makes them think they're IBM Graphics Printers, the two chips for the 82A do much less. With or without Plug 'n' Play, the 82A prints the PC's high-order characters as chunky block graphics.

For regular graphics (what you want to see from 1-2-3, for instance), you'll need the \$49 APA (All Points Addressable) graphics ROM chips. The Plug 'n' Play chips and the APA graphics chips fit in the same place, so they can't both be installed at once.

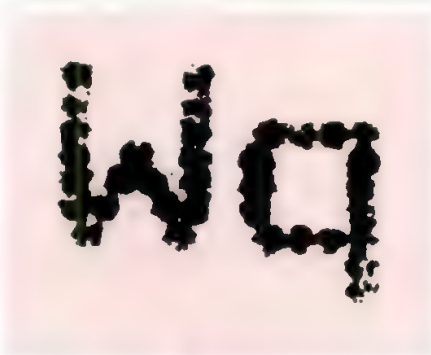
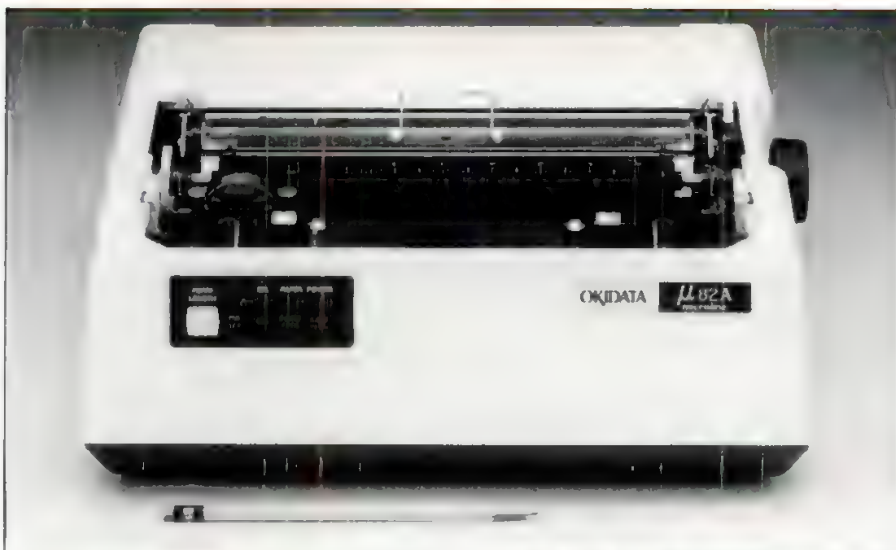
Five character pitches are available from the nine-pin print head. Normal is 10 cpi pica type. Most users will find the Okidata's default print quality slightly higher than the Epson's. Other pitches include 5 cpi (wide), 16.5 cpi (compressed), and 8.3 cpi (compressed-wide) boldface print.

They get the job done, but the quality is nothing to write home about, and none of them even vaguely approaches correspondence quality. DIP switches invoke eight foreign character sets: British, German, French, Swedish, Danish, Norwegian, Italian, and "TRS-80." You need a screwdriver to remove the printer cover to get at the eight DIP switches.

The printer is housed in a nondescript 14- by 13- by 5-inch, 20-pound box. Front-panel controls include Form Length, Set Top of Form, Select (bring

printer on-line or off-line), Form Feed, and Line Feed. For some inscrutable reason, the Form Length dial assigns arbitrary numbers (for example, 11-inch paper is a 7).

Okidata ribbons are cheap, a dozen for \$38, because they're messy, short-lived spools, not self-contained cartridges. The distinctly middle-of-the-road manual consists of a 96-page soft-cover pamphlet that is not IBM-specific. A two-page appendix covers the PC, and information on the Plug 'n' Play ROM chips is in a separate



Microline 82A

Okidata, Inc.
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600

List Price: \$349, \$39.95 for Plug 'n' Play option.

CIRCLE 669 ON READER SERVICE CARD

using the Power On Default feature(s).

using the 8.3 cpi, bold feature(s).

using the 10 cpi, standard print feature(s).



Wq



GLP

Centronics Data Computer Corp.

1 Wall St.

Hudson, NH 03051

(603) 883-0111

List Price: \$314

CIRCLE 721 ON READER SERVICE CARD

using the Power On Default feature(s).
 using the emphasized feature(s).
 using the emphasized and double-strike
 feature(s).
 using the near letter quality feature(s).

pamphlet.

Should you buy an Okidata 82A? Not if you want high-quality printing and effort-less IBM PC-compatibility and graphics capability. For that, you should look at Okidata's newer 92/93 line. The 82A is a possible choice if you want a cheap dot matrix printer for drafts and program listings. The 82A is also useful if you have a second computer, not a PC, that has only a serial printer connection, since the Okidata contains built-in parallel and serial interfaces. —William K. Howard

Centronics GLP

GLP stands for Great Little Printer, a term that does not exaggerate the abilities of this amazing, new 6-pound dot matrix wonder. It takes up less space than a box of cookies, could conceivably be hand-held through a print run (then stored in a desk drawer), and doesn't make a whole lot of noise about itself.

It's not fast, but it produces excellent-quality matrix fare at its default speed of

30 cps and correspondence quality at 12 cps. And it costs just over \$300!

Setup procedures are simple. You plug in the power cord, attach either a parallel or serial cable to the rear, and load the paper. That's it! The only buttons on the front panel are for on-line/off-line and form feed. Form feed and top-of-form control would have been nice, but as it is, everything is pretty tight inside the less-than-3-inch-high unit.

Paper loading is simple and smooth, and the mechanism didn't jam once during the tests. Either single sheet, roll, or fan-fold paper can be used, as long as it does not exceed the 9½-inch carriage. I did experience slight slippage of fanfold without the optional pin-feed roller, but I had placed the paper stack at an angle that caused drag. Still, I would recommend the optional pin feed. You can roll back the paper with the platen knob if you want.

The printer does not have elite pitch, but you can choose from wide, compressed/wide, pica, and compressed type. Other enhancements include near-letter quality characters that are impressive from this tiny printer, emphasized characters, and double strike. The last two may be used together for a darker print.

The Great Little Printer supports the full IBM PC character set. Subscripts, superscripts, and underlining are all invoked with escape codes. Alas, you must do without proportional spacing, but what do you expect, egg in your beer?

Most of the page-formatting features are equivalent to those found in printers costing twice as much as this one; so you really don't have to sacrifice much to save space. And its graphics are PC-DOS compatible and clean as a whistle!

Outfitted with the tractor drive assembly, I'd prefer this printer to my IBM PC Graphics Printer. It's certainly quieter and smaller. In fact, as I held the GLP on its side and watched it continue printing flawlessly, I considered mounting it on the wall or bolting it under my desk. Centronics really should have called it Super Little Printer. —Phil Wiswell

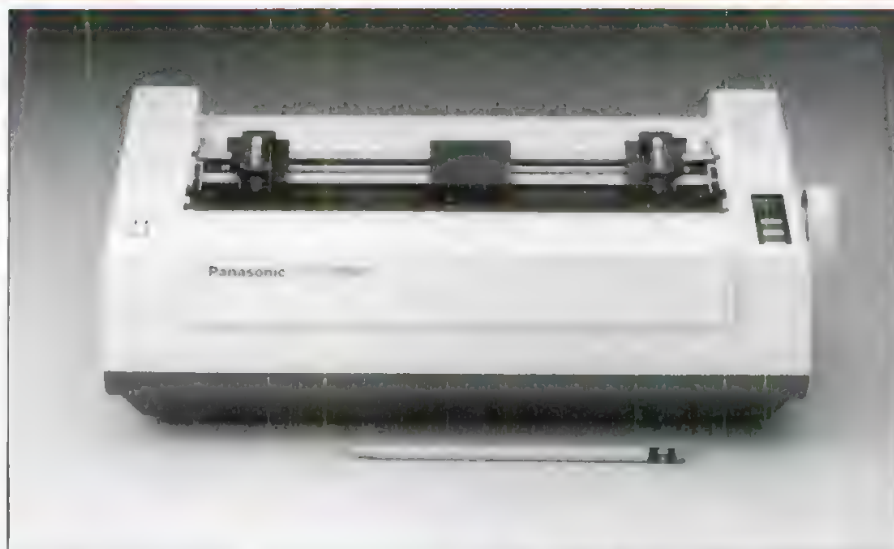
Panasonic KX-P1091

Panasonic's KX-P1091 was among the widows and orphans left over at the close of Project Printers, abandoned by its makers to the cruel fate of being reviewed without the benefit of documentation to tell me what features to look for. Panasonic had been advised of the lack of documentation some weeks earlier; the little printer was pushed aside until later review, and almost forgotten. Panasonic's promises notwithstanding, no manual or instructions ever came, and so, in the final hours of our massive printer effort, with a sadistic gleam in my eyes, I attacked the helpless, unprotected KX-P1091.

The little KX-P1091—and it is a little machine—passed the first test handily. I plugged it in right out of the box and started printing, although it was a rather clumsy machine to stuff paper into. It has three different print modes that you can select by moving a switch right on the front panel, and so the problem of undocumented escape codes was solved. It has a typical single-pass data mode and a double-pass correspondence quality mode, as well as a condensed proportional mode. It's also compatible with DOS GRAPHICS.COM, and it does a creditable job at graphics.

Toiling at the KX-P1091 and uttering a few unprintable expletives along the way, I gained access to its rather small bag of programmable tricks. I had a distinct feeling that this little Panasonic really doesn't do very much for its \$499 price tag.

In my efforts to get some technical information from Panasonic, I was referred to an individual but informed that he was in a meeting for the rest of the day. The following day I was told that he was out of town and "there's no one in technical support today." A phone conversation with someone in the sales department seemed to confirm that I had probably found most of the features the printer has, and, no, it doesn't have very many.



KX-P1091

Panasonic

1 Panasonic Way
Secaucus, NJ 07094
(201) 348-7183

List Price: \$499

CIRCLE 700 ON READER SERVICE CARD

using the Power On Default feature(s).

The KX-P1091 apparently offers no underlining, expanded or compressed type, or other goodies expected in printers. Given Panasonic's lack of interest, I'd call the KX-P1091 a total strikeout.

—Jim Forney

Seiko DPU-40

The Seiko DPU-40 is a winner in at least two categories. It is both the lowest-priced printer in this survey and, not sur-

prisingly, the smallest. I also nominate it for the Cutest Printer Award. When I say small, I mean it's so small that a Texan could probably keep one under his ten-gallon hat. The DPU-40 prints on 3-inch rolls of paper, uses DC power, and comes with a separate transformer like the ones for calculators and tape players.

It's also quiet, though it is not quite as quiet as an ink jet printer. All you hear is the little motor that draws the printhead back and forth and feeds the paper. It prints just 40 columns per line, and the

printhead covers the entire line whether it needs to or not. This happens even when you press the line-feed button to advance the paper.

Incidentally, the on/off switch and the line-feed button are the *only* controls on the printer. No DIP switches, no form feed, no on-line/off-line switch. Just plug in a Centronics parallel cable and go. I had a little trouble, however, with the connector for my parallel cable; its housing was too large to fit in the printer's slot. I removed the retaining clips from the print-

er, but even then I had to clip off some of the plastic tabs on the edges of the cable connector.

Once hooked up, though, the printer worked fine. It handled the lower-order character set, but the upper-order characters came out as Japanese Kanji symbols. If a line was longer than 40 characters, it automatically generated a carriage return and line feed, then continued on the line below.

The DPU-40 did not react at all to the form-feed character (ASCII 12), however,

this is really not all that surprising since it uses roll paper. When I tried to use the PrtSc key for a screen print, it responded with a blank line (or one starting with an asterisk) and then it just froze up. I had to toggle it off and on in order to make it go again.

The typeface is clear but not elegant, and it lacks descenders on the lowercase letters. It has no alternate fonts (other than the Kanji), no boldface, no underline, no compressed or expanded print, and it only prints from left to right. Yet it still manages to produce better than 13 characters per second.

Clearly, this is not a printer for word processing or large spreadsheets. But, if you use a notebook portable, or even a transportable computer, you might find this a useful piece of equipment. If you reformat your output for 40 columns, you could even use it as a traveling printer for hard-copy drafts and spreadsheets. Even with its transformer, it is an inexpensive, compact, and lightweight addition to any traveling computer system.

—Alfred Poor

Micro Peripherals "S"printer

The MPI "S"printer is a portable dot matrix printer that is truly portable. Its molded-plastic travel cover, complete with carrying handle, attaches to the printer with two thick plastic clips and includes space for about 250 sheets of fan-folded paper.

While this is a good feature, the cover's edges are very sharp. It's too easy to cut your finger opening it, as I did.

The built-in tractor feed is also a good idea, however, it can often be difficult to get the paper to align perfectly with the adjustable tractor-feed mechanisms. Moreover, when the TOF key is pressed the paper tends to advance extremely rapidly, which caused it to jam several times during our tests.

The cartridge ribbon is one of the



using the Power On Default feature(s).



DPU-40

Seiko Instruments U.S.A., Inc.

2990 W. Lomito Blvd.

Torrance, CA 90505

(213) 530-8777

List Price: \$124.95

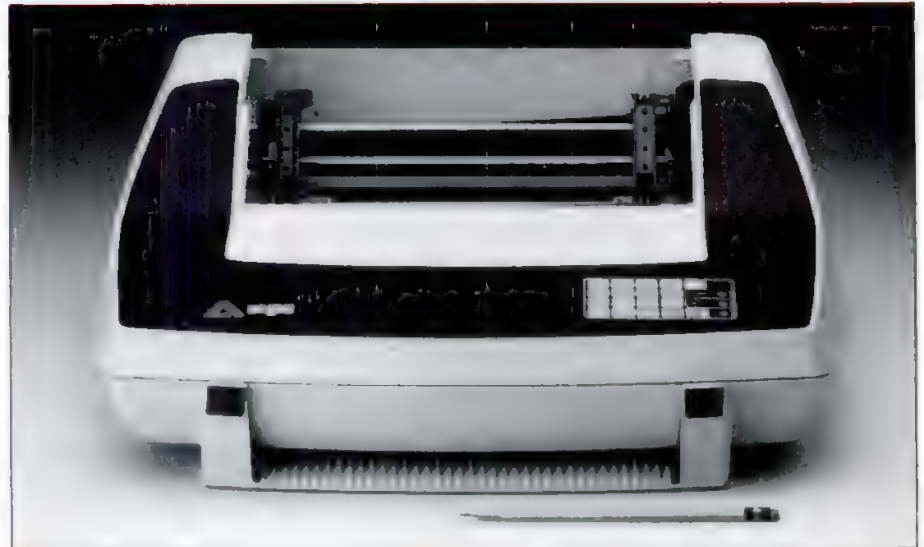
CIRCLE 792 ON READER SERVICE CARD

"S"printer's better features. Changing the ribbon is a relatively neat and clean process, and with just a little bit of practice, the whole operation should take less than a minute. Another good feature is that the "S"printer accepts fan-folded paper in two ways. First, there is a special tray with paper-size alignment bars in the front of the machine. Moreover, this tray raises the printer a fraction of an inch from the surface it rests on, thus enabling it to accept fan-folded paper from below, either in front or in back. Consistent with its portable character, there is no need for a special raised printer stand or table.

The "S"printer has two additional special features. It comes with 4K of buffered memory, which you can expand to 16K, 32K, or 64K. And it has its own Softswitch key pad, similar to a Touch Tone phone or a calculator pad, which enables you to preprogram your own paper-formatting commands. The keypad enters commands in a battery-powered, non-volatile memory, so the "S"printer retains them even when the power is turned off. This added convenience means the printer is ready immediately each time you turn it on. Among the commands that can be entered on the Softswitch pad are settings for horizontal and vertical tabs, the left margin, and serif character sets. You can have the printer print out a list of the commands you have previously entered, and you can change them relatively easily.

The "S"printer has a few minor flaws besides those already mentioned. It does not have a platen knob to advance the paper manually, and the location of the platen at the bottom of the view window makes it very difficult to align the top of a sheet of paper. In addition, you cannot change type pitch in the middle of a line.

Nonetheless, at our tested 78 cps, the MPI "S"printer provides relatively good print quality with a minimum of noise. For PC users who need to take a printer along with them, the "S"printer may be just the one to take.—Roy Katz



MPI "S"printer
Micro Peripherals, Inc.
4426 S. Century Dr.
Salt Lake City, UT 84123
(800) 821-8848
(801) 263-3081 in Utah
List Price: \$595

CIRCLE 799 ON READER SERVICE CARD

using the Power On Default feature(s).
using the AFTER 'COMPRESSED' FEATURE WA
using the AFTER EMPHISED FEATURE WAS ENABLED

Dataproducts SPG-8010-2

The Dataproducts SPG-8010-2 dot matrix printer has many neat features and one major problem: abominable print quality in all three fonts.

The three fonts are called "data processing quality," "text quality," and "letter quality." The data processing quality is an insult to data processing per-

sonnel everywhere. The dots are so distinct, they look as if you could pick them up with tweezers and stack them on your desk. The text and letter quality modes are more readable, but the skinny sans-serif typefaces do not look at all like what might come out of a typewriter.

The bidirectional printhead, normal even on inexpensive printers, is the most inaccurate one I've ever seen. In the data processing quality mode, alternate lines come out slightly askew, while the text and letter quality fonts produce a smudgi-

ness around the characters.

Data processing quality is pretty fast—over 80 cps—but rejecting that and settling for letter quality cuts the speed down to 22 cps. Combining letter quality with the emphasized mode and double strike to increase the chances that the results will survive photocopying brings the speed down to under 6 cps. That's about 8 minutes for a single-spaced page with 1-inch margins. I suspect I could have improved print quality some by turning off the printhead bidirectionality, but that

would slow down the machine even more.

Although the SPG-8010-2 completely flunks some areas, it excels in others. It's manufacturer claims compatibility with the "IBM 5152" (known to the rest of us as the IBM PC Graphics Printer). Dataproducts also provides a nice extension to the set of control sequences. The SPG-8010-2 not only produces the IBM special screen graphics, but it prints the double-line graphics with real double lines. Most printers that print this character set (in-

cluding IBM's Graphics Printer), print one line instead of two.

So, it looks like Dataproducts is serious about IBM compatibility. That would make you think the SPG-8010-2 could print a graphics display from the color graphics monitor, wouldn't it? Don't get your hopes up. The display is printed in strips, each about a 1/4-inch high, separated by blank lines of the same height.

But here's something you won't normally find in a printer in this price range: proportional spacing and right justification. To use this feature, first set the left and right margins, to 10 and 70 for example. That would allow a maximum line length of 60 characters. Then use control sequences to turn on proportional spacing and right justification. The printer does the rest. Send it a line of 55 characters and it will insert enough microspaces to line up the left and right margins.

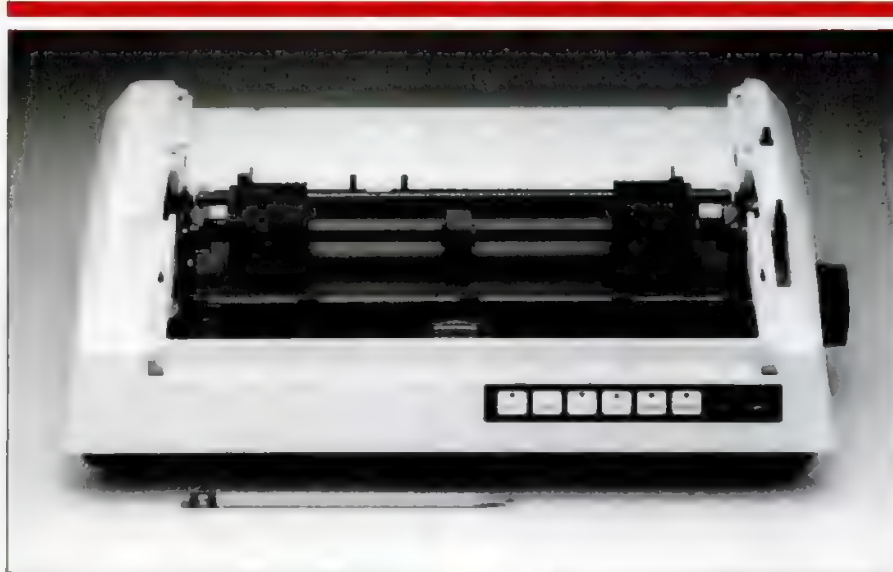
If you use proportional spacing with letter quality print, however, you're in for a surprise. The letter quality print pitch shrinks from 10 to 14 characters per inch when proportional spacing is turned on. Although the manual tells you this will happen, it doesn't say why.

Another smart feature allows you to set the printer to accept either binary or ASCII arguments. For BASIC programmers, this means the difference between entering a CHR\$(1) or just a 1.

And the manual mentions something even better than proportional spacing: downloadable character sets. But where is the documentation? How do you download? Without that information, you might as well not have the feature.

I can't understand it. Why would Dataproducts go for the fancy stuff when the print quality is so bad? This printer is like an idiot savant. It can do cube roots in its head, but can't tie its shoes.

I must note, however, that the paper catch in back of the printer worked excellently. The paper dropped right into it and folded all by itself. I only wish the printer it was attached to worked nearly as well. —Charles Petzold



SPG-8010-2

Dataproducts
Route 13
Milford, NH 03055
(603) 673-9100
List Price: \$649

CIRCLE 718 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Text Quality feature(s).

using the Letter Quality feature(s).

**Thinking of
buying a modem?
You owe it
to yourself to check out the Qubie' 212A modems.**

Inside Outside

Just a few years ago, computers needed big air-conditioned rooms to operate in, balefuls of money to buy, and a team of wizards to keep them running. The constant march of technological progress has given more and more powerful machines which cost less and less. Desktop computers more powerful than the early mainframe computers are the result of the evolution. The Qubie' modems represent the latest extension of this progress. Because up until now, a 212A compatible modem cost at least \$500. Through the use of four low-cost, state of the art microprocessors, we can now offer two versions of our full featured 212A modem at prices the competition sells 300 baud modems for.

In The Beginning

In September of 1983 we introduced the first 212A modem card for the IBM PC available for under \$300. The PC212A/1200 is a complete communications package including PC-TALK III software, modular phone cable, card edge guide, and instruction manual. The modem is an auto-dial, auto-answer type, which uses all the Hayes software commands so it can be used with any of the popular software packages including Crosstalk™, and Smartcom™. We picked the best software package we could find based on it's ease of use and features, PC-TALK III. Our modem includes features the old industry standard missed out on. Like being able to fit in one slot in a Portable PC or PC/XT.

Or an optional connector to use the modem's serial port when not using the modem. Of course the topper is the \$299 price, hundreds less than the competition.

Now Available Outside

Our standalone modem, the 212E/1200 can be used with any computer or terminal with a RS-232C serial port. You can use any Hayes compatible communications software on anything from an Apple to a Zenith. Many owners of IBM PC's are using it because they lack available expansion slots, or have more than one computer they want to use their modem with.

It's attractive gold anodized case houses seven status lights (who says low prices means a shortage of features). It fits comfortably under a standard telephone. It is also a 212A compatible auto-dial, auto-answer modem which supports all Hayes software commands. Even the switch settings are the same, so any software giving recommended switch settings for a Hayes modem can be used, without knowing what the switches do. There is a volume control knob for easy adjustment of the speaker's output. Included in the package is modular phone cable, a cable to hook it to your computer or terminal, and instruction manual. Choose the communications package right for your needs, and you're ready to go!

Four Hearts

The heart of the Qubie' modems are four digital signal microprocessors. Two handle sending, and two do the receiving. Rather than attempt to filter all but the relevant tones used for modem communications, the

microprocessors measure the tones digitally. This allows them to overcome line noise and static better than analog filter based modems

Why Buy From Qubie'

Because you will get a product as good or better than any available, pay less for it, and get factory direct help if you need it. If at any time during the one year warranty period your modem should require service, we will fix it or replace it within 48 hours. Notice also there are no hidden charges in our prices. No extra for freight, insurance, credit cards, or COD fees. In a hurry? UPS 2nd day air service is just \$5 extra. If you are like many who say, "Nah, it's too good to be true," just apply the acid test and find out. Then you will be asking yourself, "Why should I pay what these modems used to cost?"

The Acid Test

Qubie' gives you a 30 day satisfaction guarantee on your modem. If you are not completely satisfied we will refund the entire amount of your purchase including the postage to return it. If you can, get anyone selling another modem to give you the same guarantee. Buy both, and return the one you don't like. We know which one you will keep.

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PC212A/1200 Includes Modem Card, PC-TALK III software, card edge guide, modular phone cable, quick reference card, and instruction manual **\$299**
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212E/1200 Includes Standalone modem with cable (specify male or female), modular phone cable, and instruction manual **\$329.**



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4809 Calle Alto
Camarillo, Ca. 93010

Tempo House, 15 Falcon Road,
London SW11 2PH, United Kingdom

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CIRCLE 227 ON READER SERVICE CARD

Personal Micro Computers DMP-85

Recently, an influx of boxlike new dot matrix printers has flooded the market. They all look like they were stamped out with the identical cookie cutter, and each one tries to recite a litany of features just a little longer than that of its neighbors. Personal Micro Computers' DMP-85 seems to live up to its claims better than most, however.

One look tells you that, no matter what the nameplate may say, this printer comes fresh from Tokyo Electronics Corp., combining aspects of pretty good machines as well as less-good ones.

It was a breeze to get up and running. You hardly need instructions to get started, but the DMP-85 comes complete with very detailed, illustrated instructions for everything, including how to remove it from the box and put in the ribbon cartridge.

The DMP-85 has the typical TEC

paper-feed system, which gives you the best of both tractor and pin feeding as well as single-sheet platen. It adjusts to take various form widths and loads easily with few jams. This is one of the few printers I've seen that can feed either forward or backward on command.

It's not superfast, but it's comfortably quick for many applications and has a full range of type sizes and other options. I ran it through the gamut of features to see if it would really do all that it claims, and I was impressed. It can print special characters for various languages, including Greek and Japanese, as well as graphic symbols. It handles six type pitches, ranging from 5 to 17 cpi, and produces an acceptable correspondence quality boldface as well as underlining. It also does bit-image graphics. You can adjust its printhead pressure for either single sheets or multicopy forms, and the manufacturer claims the DMP-85 will print up to three carbons.

All in all, this is a rather interesting printer. Unfortunately, it is available only direct from Personal Micro Computer, and in recent months the company hasn't even been advertising. It's a shame.

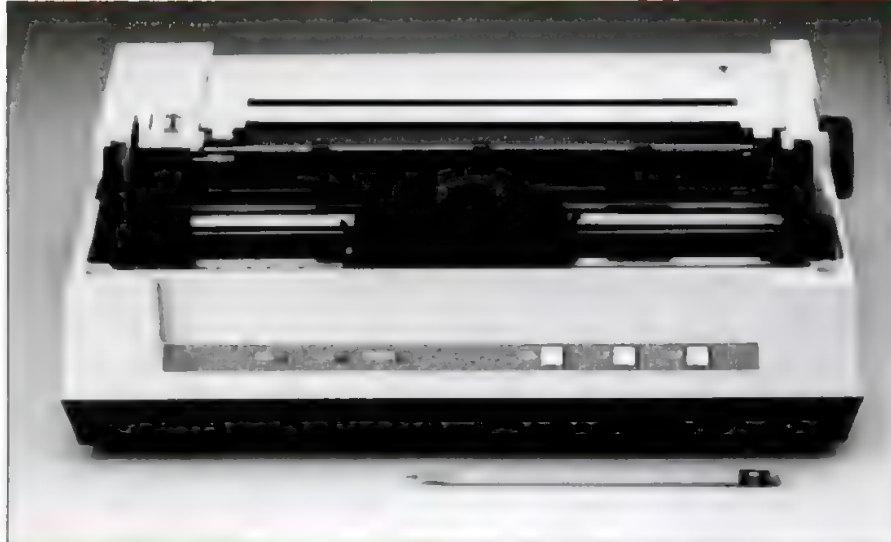
—Jim Forney

Axiom Seikosha GP-550

The GP-550 I tested seemed to suffer from a severe identity crisis. It didn't know if it was an *Axiom* GP-550, as indicated in the advertising material, or a *Seikosha* GP-550, as indicated in the manual. And what kind of GP-550 was it? Was it the standard GP-550A or the PC-compatible GP-550PC?

The metal label on the back of the printer case said GP-550A. So did the manual. The label on the removable plastic lid said GP-550PC (and included the magic words "for the IBM PC"). The carton read GP-550, and somebody had scrawled in "PC" at the end.

Those two letters make a big difference! Unlike the GP-550A, the GP-550PC "includes IBM PC Graphics character



using the Power On Default feature(s).



DMP-85
Personal Micro Computers
375 Santa Ana Ct.
Sunnyvale, CA 94086
(415) 962-0220
List Price: \$395

CIRCLE 764 ON READER SERVICE CARD

This

**"Finger
Friendly"
keyboard**

will make you more productive everytime you turn on your IBM PC.

Finger Friendly

Do you love your PC, but hate its keyboard? Would you like to have a quiet keyboard, with keys in the standard typewriter position? Now there is a low cost alternative to the IBM keyboard. Look at the improvements:

- ☐ **A Wider, Left Hand Shift Key/in the Standard Typewriter Position.**
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- ☐ **Lighted Indicators on CAPS LOCK and NUM LOCK Keys.**
- ☐ **A Long ENTER Key Next to Ten Key Pad for Adding Machine-Like Entry.**
- ☐ **Long Life, Capacitive Key Switches with Micro-processor Control.**
- ☐ **No Irritating Clicking Sound.**

- ☐ **Finger Homing Bumps on F, J, and 5 Key of Numeric Pad.**

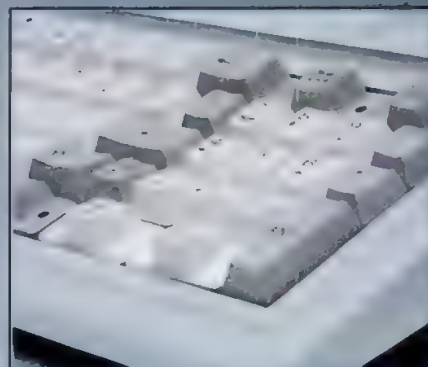
- ☐ **Two Stage Key Resistance Gives Tactile Feedback Through Your Fingers, not Your Ears.**

And those are just the improvements! You don't have to give up the color matched, low profile case. Or three position height adjustment. It's the enhancement that will make you more productive everytime you turn on your PC.

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Part No. FF5150 \$139.

CIRCLE 384 ON READER SERVICE CARD

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control codes" and "replaces italics and Quad Graphics with IBM PC graphics symbols."

To determine the printer's true identity, I performed two standard printer tests designed to elicit certain responses from control sequences. The machine humbly failed both. The IBM screen graphics characters printed as foreign letters. The IBM screen graphics dump (with the PC-DOS graphics program loaded) printed mostly slashes and form feeds.

It became evident that I was dealing with a GP-550A with a GP-550PC plastic lid. Unfortunately, the PC ROM wasn't built into the lid or this swap might have worked. When contacted, Axiom admitted that a shipping mix-up had probably occurred, and assured me that the GP-550PC really is PC-compatible.

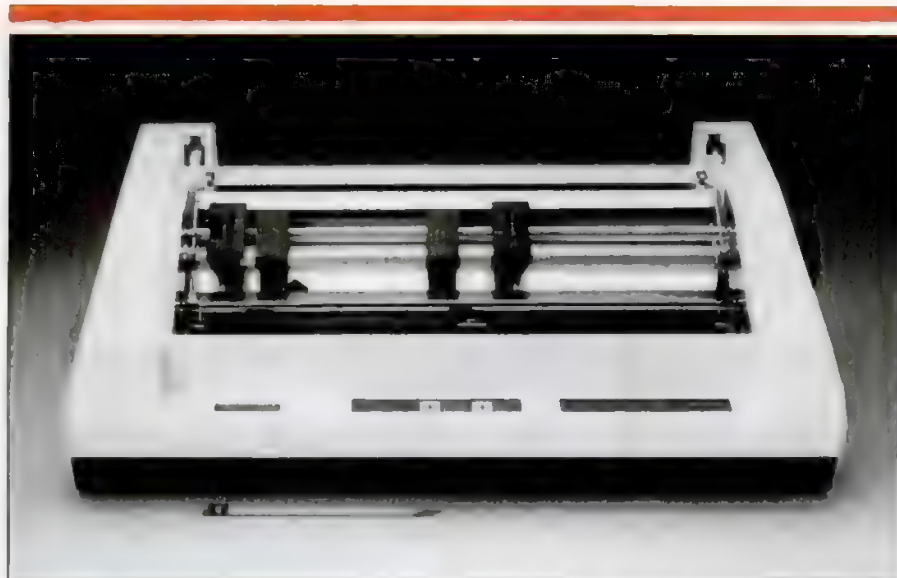
Compatibility aside, the GP-550's standard print was a fuzzy, cloudy mess. Its resistance to photocopying might make it suitable for organizations dealing with

secret or classified documents, but that's about it. Worse yet, the "correspondence quality" is actually just a heavier but still very blurry emphasized mode. The print quality was so bad I started to question my eyes instead of the printer.

Of course, the GP-550 had some good points. The little ribbon cartridge was one of the cutest I'd ever seen. With the cover down, the machine was pretty quiet. The cover swivels and rests on either the front or back. In a piece of brilliant design, a split rubber tube connected to a tag that says "Pull this tag" holds the printhead in place during shipping. The tube came right off and went back on easily.

Best of all, the \$299 GP-550 offers a proportional typeface with thin periods, commas, and "I"s. Unfortunately, the manual doesn't document this feature to enable programmers to use it to make the printer justify right margins.

The GP-550's faults are magnified by overaggressive marketing hype. Ads have called it "The First Real Personal Printer for Home and Business," and claimed it produces "beautiful near-letter quality" printing. In the face of all those promises, the GP-550 printer delivers mostly disappointment. —Charles Petzold



Seikosha GP-550
Axiom Corporation
1014 Griswold Ave.
San Fernando, CA 91340
(818) 365-9521
List Price: \$299

CIRCLE 796 ON READER SERVICE CARD



using the Power On Default feature(s).
using the Correspondence Pica feature(s).
using the Bold with Correspondence Pica feature

Okidata Microline 92

If the features you're looking for in a dot matrix printer are respectable speed, near-perfect reliability, compatibility with the Epson/IBM Graphics printers, and an almost letter-quality, low-speed option, the Okidata Microline 92 may well fit the bill—if you don't mind changing dirty ribbons.

The \$599 Microline 92 (ML92) is the normal-carriage (80 columns) Okidata. An extra \$300 buys the wide-carriage version, the Microline 93. Both versions have been on the market since 1983.

You can also choose either a generic set of ROM chips or the Plug 'n' Play option, a pair of chips that make the Okidata think it's the IBM Graphics printer. Both types

**Protect
Your Investment
In Hardware
And The**

Integrity Of Your Data With A Qubie' Standby Power System

Your local power company is not equipped to provide the filtered, constant power your micro needs for dependable operation. That's why you need a steady flow of clean, regulated power provided by the SB200 or XT300 Standby Power System. They will protect the delicate circuitry in your PC from damage caused by brown-outs, black-outs, surges, spikes, and electromagnetic interference (EMI).

No Snow

Most of us are vaguely aware of the need for protection from power disturbances. Everyday ordinary appliances like electric drills or vacuum cleaners add EMI to the line. It's what causes the snow on your TV picture, the buzz on your radio, and makes your computer make unexplainable errors. Special circuitry filters out these line disturbances. The SB200 and XT300 provides about double the noise filtering of competing products.

Long Life Protection

The typical filtering device does supply some protection against surges. Most of these use a component called a metal oxide varistor (MOV). MOV's are inexpensive, and they work fine for awhile. The bad news is each time an MOV absorbs a surge, its usefulness is diminished. After awhile, MOV's are just like an expired insurance policy—they look like protection, but don't try to collect. The SB200 uses an avalanche diode for fast reaction to small surges,

(just .1 nanoseconds) and a gas discharge tube for longer surges at higher voltages. Unlike varistors, these two devices do not lose effectiveness with use, and can shield your computer from up to 1,000,000 watts of power!

"Lights Out"

What about the other side of the coin. Like a momentary drop or even a blackout of power? We've all seen the lights suddenly dim or brighten as a copy machine, arc welder, or air conditioner turned on or off. Or those hot summer days when the power company lowers the line voltage. Reduced voltage causes your PC's electronics to overheat, decreasing their life up to 50%. Plain old surge protectors are helpless. Your data gets scrambled and you don't have a clue why.

Bell Labs monitored the power at 24 computer sites of the Bell operating companies and found that 87% of power problems were voltage sags!

You need a source of standby power that can step in and keep your PC going when the power company lets you down. The SB200 has its own battery which comes on-line as soon as voltage drops below 108 volts. With just 4 to 10 milliseconds notice it will keep your PC going as if nothing happened. The XT300 provides a faster response time (1 to 4 milli-

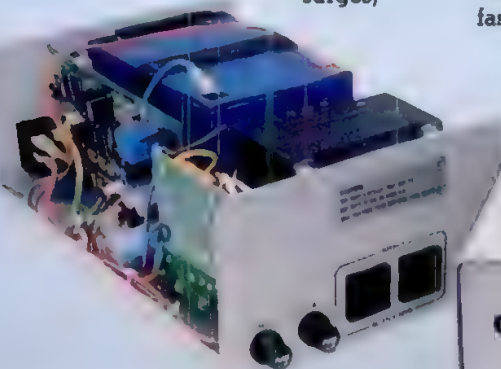
seconds), and a larger battery capable of 300 watts of output. The faster response time is required by some computers with sensitive power supplies like the IBM PC/XT. A red indicator light and alarm buzzer warn you that your PC is now running on back-up power. You now have time to complete any job you are performing, save your work to disk, and power down your system.

Without standby power you could lose hours of work, or worse yet, have precious data damaged without you knowing it!

The Qubie' Acid Test

When you buy from Qubie' you get back-up on your purchase. Start with a one year parts and labor warranty. We perform all repairs within 48 hours or we replace the item. You get the protection of the Qubie' Acid Test. We guarantee your satisfaction for thirty days from purchase or we give you a complete refund including the cost of the freight to return the item.

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SB200 \$329, XT300 \$429. Includes UPS surface freight, and insurance. Add \$15 for two day air service. For fastest delivery send certified check or credit card. Personal checks take 18 days to clear. Calif. residents add 6% sales tax. Corporations & Institutions call for purchase order details.

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CIRCLE 391 ON READER SERVICE CARD

of chips work with the IBM PC, but Plug 'n' Play works better. (You can buy Plug 'n' Play later for \$50.) If you opt for the Plug 'n' Play chips, the PC-specific manual supplied will help you tell your PC's programs they're talking to an IBM Graphics Printer, not an Okidata. Without Plug 'n' Play, you won't be able to recreate the PC's monochrome graphics characters, and the printer will not be graphics compatible with the IBM.

When we tested the ML92, it chugged along at 91 cps in draft mode (making it a

shade easier to read than the Epson/IBM draft mode) and at 31 cps in the excellent correspondence quality mode. If you absolutely cannot afford both dot matrix and letter quality printers, the ML92 is a viable alternative. Okidata's correspondence quality printouts will fool most of the people most of the time, especially if they're photocopied.

The ML92 is a chunky 20-pound unit. It lacks the sleek look of the Epson line, but beauty is all it sacrifices. Five front-panel controls set form length, register the

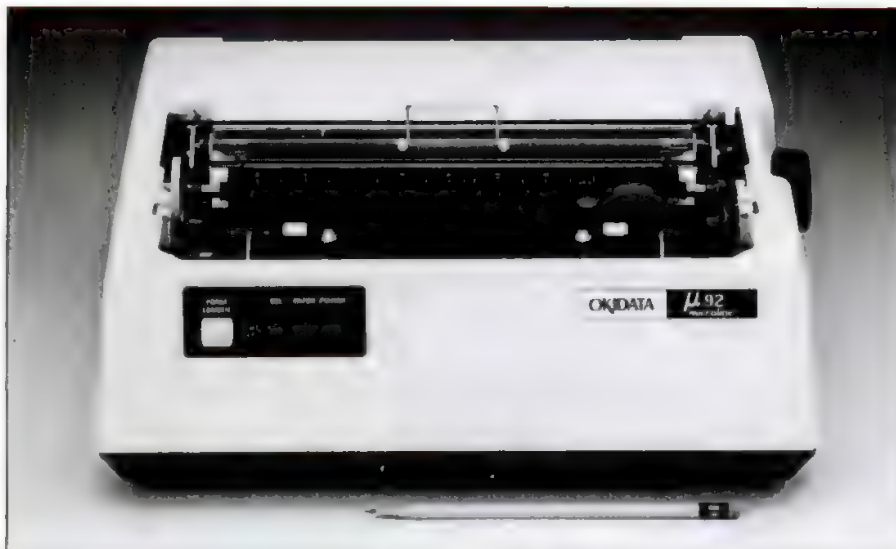
top of form, select the printer (take it on and off line), and advance a form or line at a time. Regrettably, there is no written indication of the dual functions of the front panel switches. Holding down TOF Set, Form Feed, and Line Feed when turning on the power brings up the printer in compressed, correspondence quality, or self-test modes, respectively.

The bulk of the time it takes to set up this unit is spent threading ribbon onto the take-up spool. Oki uses ribbons, not snap-in cartridges. And while they're cheap (12 cost \$38), they're also very messy. (Okidata should pack a pair of disposable rubber gloves with each ribbon.) Installing the ribbon for the first time is confusing (the illustration embossed on the underside of the cover is more descriptive than the one in the manual). A bit of advice: If you're paying list price, have your dealer install the first ribbon.

A fixed-width pin-feed platen is standard. It takes single sheets easily. Fan-fold paper, however, is more difficult to load, and you can expect to crinkle a page or two the first time you try it. I recommend using the optional (\$50) variable-width tractor if you regularly use fan-fold paper. The Okidata ML92 ran flawlessly once the ribbon and paper were in place.

The upgraded manual represents a rare phenomenon—Japanese technical know-how, succinctly explained in the English language. No more "Please to adjust fan-fold lever inseparably from platen hold-down indicator for happiest operation." Nontechnical users will like the manual because background information on printer set-up codes allows you to understand what you're doing. Specific notes apply to *VisiCalc*, *SuperCalc*, *SuperWriter*, and *WordStar*.

Type pitches and densities available on the Microline include pica type, 10 cpi, in draft mode; correspondence mode; enhanced (each character struck twice); emphasized (bolder than enhanced); compressed, 17 cpi, allowing for 136 characters across an 8-inch page; double width, 5 cpi; and compressed width, 8.5 cpi. There



Microline 92

Okidata Corporation
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(800) OKI-DATA, (609) 235-2600
List Price: \$599

CIRCLE 710 ON READER SERVICE CARD

using the Power On Default feature(s)
using the Default features feature(s)

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\$449 includes:

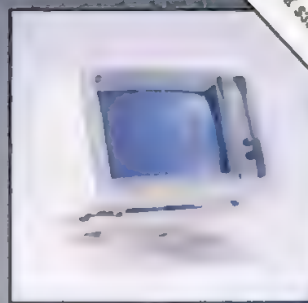
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- 720x348 1-2-3™ compatible graphics
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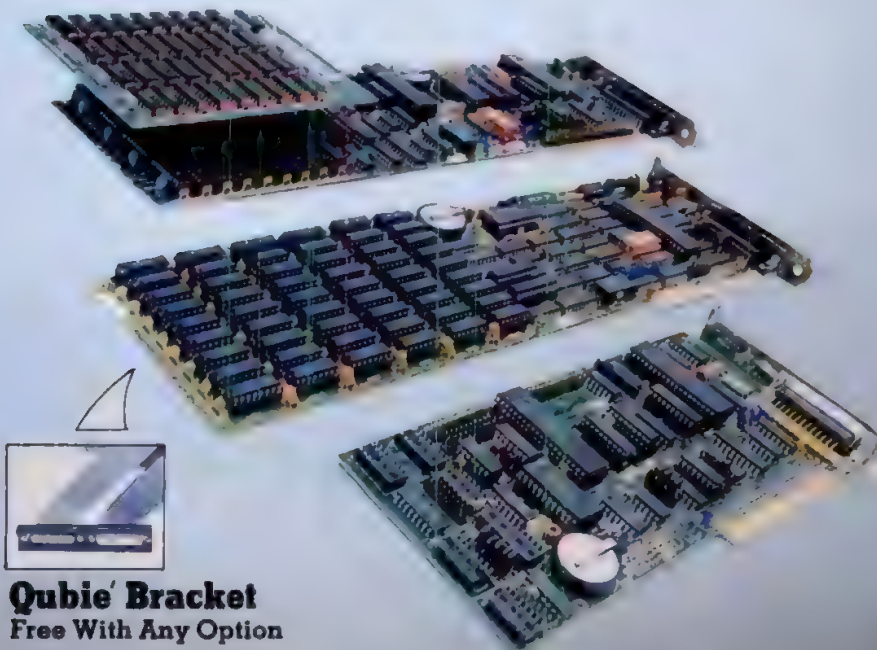
Inside California

QUBIE'

4809 Calle Alto
Camarillo, CA 93010

Tempo House, 15 Falcon Road,
London SW11 2PH, United Kingdom

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Qubie' Bracket
Free With Any Option

is no 12-cpi (elite) option.

Graphics mode offers 60 by 72, 120 by 72, or 240 by 72 dots per inch. The Okidata printer does its thinking in $\frac{1}{144}$ inch, while the IBM Graphics Printer uses $\frac{1}{216}$ inch increments. To mimic the IBM, the ML92 multiplies depth commands by $\frac{3}{4}$. The result is a light band every $\frac{1}{6}$ inch on some graphics (not the end of the world, but also not 100 percent PC compatible).

If you buy the Microline 92 to use with your PC, most people will tell you to get

the Plug 'n' Play version. But if you don't care about the PC's graphics or character set, bear in mind that the standard chips, offer features not available with Plug 'n' Play.

Although the escape sequences are different, both perform the same text-printing functions, with one often-overlooked difference: standard chips enable you to use elite (12 cpi) pitch; Plug 'n' Play chips don't.

Because elite pitch can be used in conjunction with other commands, the stan-

dard chip set gives you more print enhancement features. These capabilities may be particularly desirable if you do a great deal of writing.

Another major difference between the features of these two variations is that downline loadable characters are only available with the standard set. If you have the hardware and the programming experience, you may find it's possible to create your own character sets invaluable, not to mention the fun you'll have trying.

On the down side, our tests proved that the ML92 prints faster in all print modes with the Plug 'n' Play chips than with the standard set. The difference isn't great enough to affect a buying decision, but it does make you wonder why.

The ML92 is solid and extremely reliable, even by the high standards of dot matrix printers. It offers compatibility with the IBM Graphics Printer and has an excellent correspondence quality mode. It's not the sleekest printer, but you should become comfortable with it quickly.

—William K. Howard and Phil Wiswell



TI 850
Texas Instruments, Inc.
P.O. Box 809063
Dallas, TX 75380-9063
(800) 527-3500
List Price: \$659

CIRCLE 758 ON READER SERVICE CARD

using the Power On Default feature(s).
using the double-strike feature(s).
using the emphasized feature(s).
using the enhanced, emphasized, and double-str

Texas Instruments 850

The TI 850 is a good dot matrix printer but not a great one. It's fast enough for many home applications, delivers a wide variety of different print enhancements, and, most importantly comes with wonderfully clear documentation. I wish I could credit the authors, but their names seem to be the only information missing from the manual.

What's more, TI has included a printer reference card, a handy item missing from most other printers. It's separate from the manual and lists the 850's escape sequences, control characters, ASCII characters and codes, DIP-switch functions, and front-panel controls. If you are familiar with any other printer, the reference card enables you to operate every function of the TI 850 without looking at the manual.

In its default mode, the TI 850 prints at

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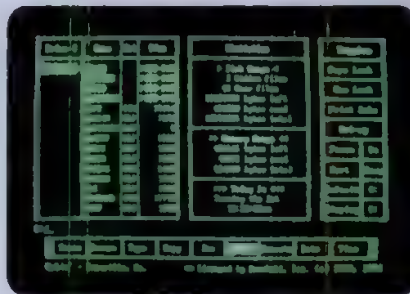
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Idirfully Easy with the popular Idir menu driven "visual shell" software. It replaces complicated DOS commands with menus that allow you to just point at what you want to do. Help files explain DOS commands and give you on-line advice when you need it. Idir takes the wonder out of the tree structured subdirectories so useful in organizing a hard disk.

Hard Problems like excessive current draw and heat have until now been unsolved problems with aftermarket hard disks. Most drives draw lots of power. If your PC has many expansion boards in it, power to run a hard disk is probably not available. Hard disks have also been easily damaged by vibration and movement. And of course the problem any non-IBM product must face, compatibility with the IBM PC. We have tackled all these problems and come up with the best solutions available at any price.

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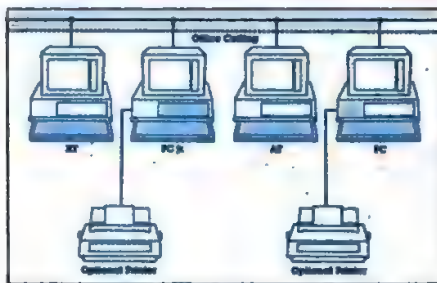


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CIRCLE 103 ON READER SERVICE CARD

96 cps, although you sacrifice half of that to improve its poor draft quality. And producing its highest-quality print slows it to an 18-cps crawl. Standard or enhanced fonts can be combined with up to three of the four available modifiers—double strike, double-width, emphasized, and compressed—for a total of at least two dozen styles. You *can* achieve nice-looking text, but the nicer it looks, the closer you come to 18 cps.

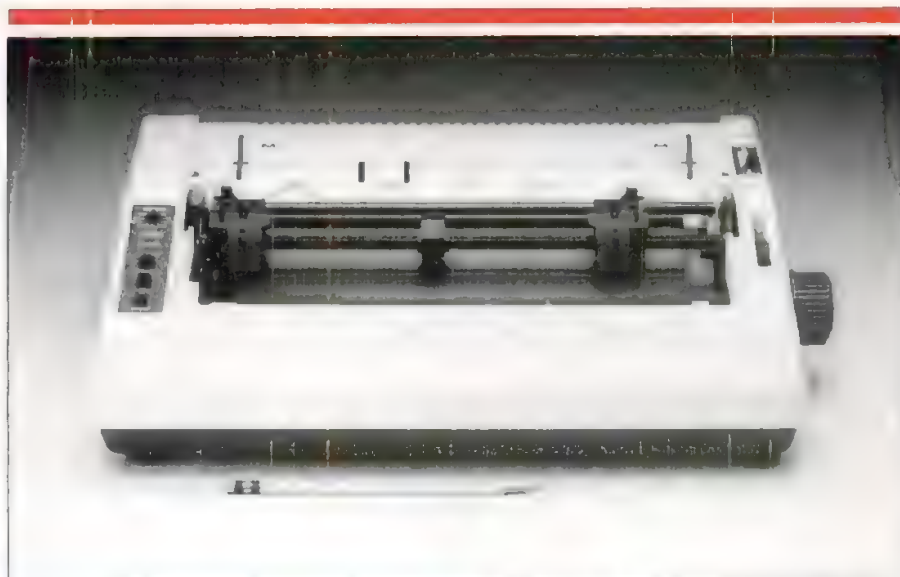
The TI 850 lacks elite pitch and proportional spacing, and you can't use compressed type with the enhanced font. There are seven foreign-language character sets. This is like putting retreads on chrome-plated magnesium wheels.

Although it has a standard carriage, and is thus no smaller than other dot matrix printers, it is much lighter and easier to move than most. It comes set up for single sheets, but you must feed them in manually. A roll-paper holder and a tractor feeder are optional. If you don't want to be tied to the machine during printing, I recommend purchasing the tractor feeder. It loaded easily and caused no jamming problems in our tests. A single button for setting pitch and form length sits on the front panel, where it belongs. You can select mosaic graphics (2 × 3 cells) or raster graphics (60, 72, 120, or 144 dots per inch) with escape codes, and the graphics capabilities of the printer are compatible with PC-DOS.

It may lack a few useful features, but the TI 850 is as easy to use as any printer I've tested. Even beginners should have no trouble setting it up and putting it through its paces.—Phil Wiswell.

4511

The 4511's light weight, under 20 pounds, indicates it might have trouble handling standard office use. For light-duty tasks such as printing letters and producing neat, professional correspondence, however, it's just what you'd want in a



4511

Facit Data Products
235 Main Durstable Rd.
Nashua, NH 03061
(603) 424-8000
List Price: \$650

CIRCLE 754 ON READER SERVICE CARD

using the Power On Default feature(s).

low-cost dot matrix printer.

One of my pet peeves, though, is printers that come out of the box with none of the DIP switches set correctly (except by accident), and this one peeved me considerably. Fortunately, you usually have to go through this unpleasant chore only once to install a printer. Regrettably, the 4511 makes it harder, because many of the decisions you have to make in selecting settings are too complicated for the average user. Universal defaults should have been set in the factory.

The 4511's measured speed of 93.3 cps was well within the range that could be expected from its 158 cps rating. And, while shifting into an enhanced mode for correspondence did slow it down to 33.5 cps, the loss of speed was less than with some office printers costing far more.

The Facit 4511 also does a nice job on graphics, slipping easily into and out of the graphics mode. You would have no difficulty including graphs just about any place you might want them in a report. It even prints all 256 ASCII characters,

although the quality of some of the high-order group leaves something to be desired.

For some reason, this machine had an impolite habit of dropping off-line whenever it sensed a new program/document coming down from the computer, and that did annoy me. I found that you really have to keep an eye on the status lights or your computer may discover it has no printer on-line waiting for output.

Overall, the Facit 4511 inspires few superlatives, good or bad. Given the com-

petitiveness of the market, that's really just a roundabout way of saying that I probably wouldn't go out of my way to pick up this particular printer.

—Jim Forney

Olympia Electronic Compact NP

The Olympia Compact NP looked a little ho-hum when I took it out of the box. You probably wouldn't give it a second

glance alongside 20 or 30 other similar printers on a shelf. That's too bad, because when I put it to work, it immediately grabbed my attention with its impressive array of tricks. It made my day.

The first thing that caught my eye was its manual—excellent in every respect. A well-bound paperback on slick stock, the manual is full of deft illustrations. Detailed instructions (the best I've ever seen) guide even newcomers through the intricacies of coaxing the printer to perform all of its special features. The manual's down-to-earth language shows and tells why and how to do things without insulting your intelligence.

The next thing I noticed about the NP, even before it had printed enough lines for me to start to judge its print quality, was how quiet it was. And the text may not be letter quality, but it looks pretty good. Use one of the enhancements to increase dot density, and the print begins to look very good.

The fun really starts when you call up this little printer's special features. For a printer in its class it has quite a few—condensed type, expanded type, elite type, and a couple of enhancements, including boldface and underlining, that work with most of these features. Choosing from among all these choices is a little like ordering from a Chinese menu. In graphics mode the NP even does windows. In one test run I printed double-width type that was both boldfaced and underlined. In fact, the printer handled all the special features I tested very well.

The NP doesn't feature super speed, but it's certainly no slouch. It wasn't to churn out reams of data or documents day after day. But it would work very well in a small office, printing everything from invoices to checks as well as general correspondence. And the NP can really shine in the home. Ultimately, it really matters how many pages you have if you can't figure out how to use them. Happily, with the excellent manual, that's not a problem.

—Jim Forney



Electronic Compact NP

Olympia International
P.O. Box 22
Somerville, NJ 08876
(201) 722-7000

List Price: \$499

CIRCLE 761 ON READER SERVICE CARD

using the Power On Default feature(s).

using the emphasized feature(s).

IBM PC Graphics Printer

The IBM Personal Computer Graphics Printer is like an old friend who owes you a couple of hundred bucks. You feel connected to it; you root for it to succeed; but in the back of your mind you always wonder whether it's worth your time and trouble.

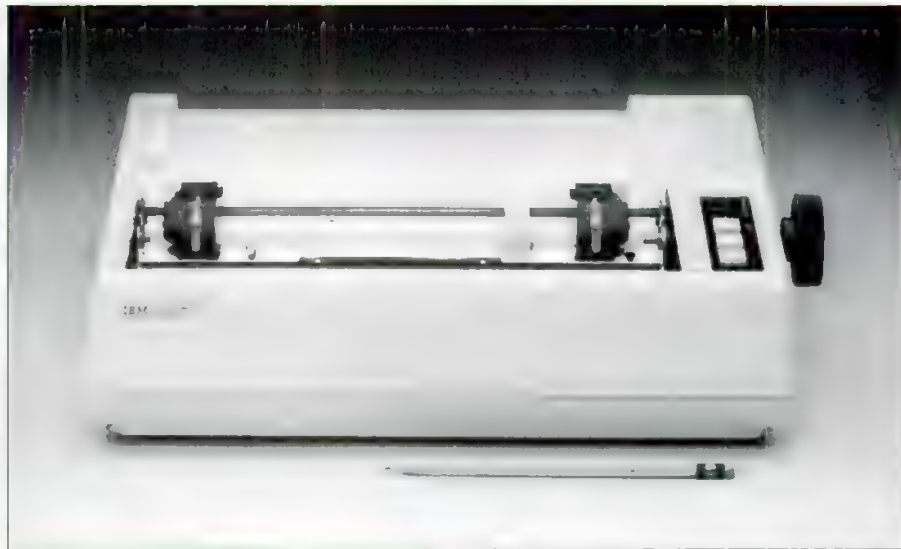
At least you never have to worry about IBM compatibility. This machine produces the IBM PC high- and low-order characters and itself defines the meaning of "PC Graphics Printer" compatibility. Installation, popping in the ink cartridge (don't get crazy and try it wearing white gloves), and setting up the rear-end paper

IBM's manual is a case of a picture's being worth 1,000 words, though given the quality, it's more like 2,000 words.

are all easy. As with much documentation, IBM's manual is a case of a picture's being worth 1,000 words—though the quality of the some of these ones, it's more like 2,000

Facit

The Facit 4 printer operational is only once it is on-line, its utility pounds, indicating you want to do. For the standing up to the operator who sends out to-medium office and doesn't really care monthly statements, the print, this printer is near-letter quality mode, while far ever, it has all the features



IBM PC Graphics Printer
IBM Entry Systems Division
P.O. Box 1328
Boca Raton, FL. 33432
(305) 998-2000
List Price: \$449

CIRCLE 782 ON READER SERVICE CARD

using the Power On Default feature(s).
using the doublew

from correspondence quality, is acceptable for basic communication. The compressed, emphasized, and double-width modes work well enough, though the results resemble the mail you get from mail-order houses—tacky, but serviceable. Underlining, superscript, and subscript all work well.

While the printer is obviously compatible with PC-DOS graphics and has some variable line-height and form-length capabilities, it lacks proportional spacing, justification, and centering. The PC Graphics

Printer allows a limited number of foreign characters, although it is fully compatible with IBM's *DisplayWrite 2* foreign-language support.

The printer's one-line buffer is just barely better than nothing, but the front-panel controls and displays are adequate and informative. The out-of-paper beep can be irritating, but so can running out of paper and having to do your job over.

In short, this printer is better than no printer at all. If you can get it at a good price, go for it. —Michael Muskal

Hewlett-Packard Thinkjet

Cute is not an adjective normally applied to computer equipment, but it is certainly appropriate to the Hewlett-Packard Thinkjet. Weighing in at just 6 pounds, this is probably the lightest and smallest printer capable of accepting letter-size paper. Its optional battery pack and carrying case make it ideal for use with a portable or transportable computer. It in-

cludes a 1K character buffer to allow your computer to compute while the printer prints. But its most endearing feature is its deafening silence while printing, a direct result of Hewlett-Packard's ink-jet technology.

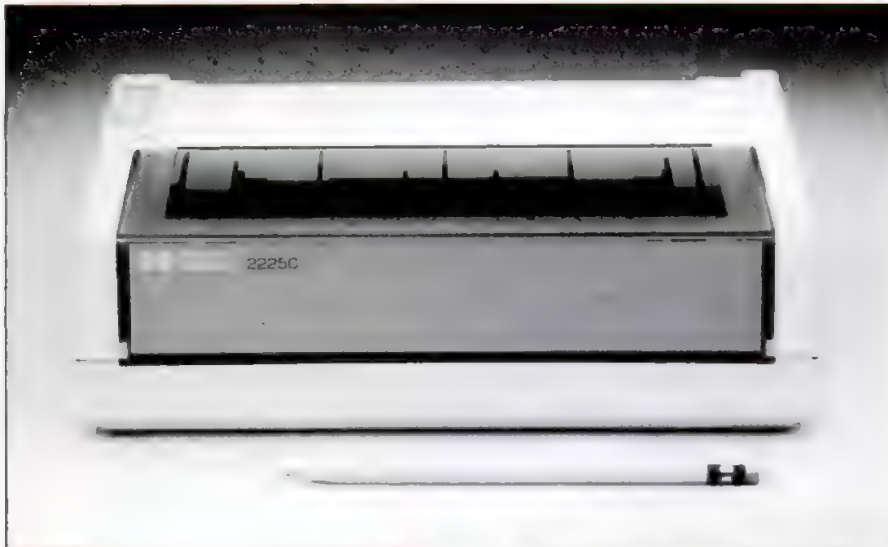
The Thinkjet holds the ink in a small disposable cartridge that costs about \$8. Removing and changing the cartridge takes 30 seconds and involves no more work than dropping a ribbon cartridge into place. Unfortunately, the quality of the Thinkjet's printing on ordinary paper

Its small size and light weight make the Thinkjet a good choice to take on the road with your Compaq or Hyperion portable.

leaves something to be desired. The print quality was acceptable using special, more-expensive paper. *PC*'s tests on plain bond paper showed a slightly skewed and hard-to-read dot pattern. This is common to many ink-jet printers. (Incidentally, the manufacturer rates the ink-jet cartridges at about 3,000 lines, and, to the company's credit, they lasted at least that long during testing.)

Hewlett-Packard rates the Thinkjet at 150 cps but *PC*'s tests didn't get it to run even half that fast. Of course, this is fairly common among PC printers because of their long line-feed times. The Thinkjet includes an integral pin-feed and pressure-feed platen that features bidirectional line spacing. The device can print PC screen dumps just like an IBM printer would, and it can respond to Hewlett-Packard as well as Epson-type graphics commands. The Thinkjet does not include the high-order character set from the IBM/Epson printer, so you must implement line drawings through software.

Its small size, battery power pack, and light weight make the Thinkjet a good choice to take on the road with your Compaq or Hyperion portable, but the print quality might become objectionable in a stationary installation using ordinary paper. —**Bill Harts**



Thinkjet

Hewlett-Packard
1820 Embarcadero Rd.
Palo Alto, CA 94303
(800) 367-4772

List Price: \$495

CIRCLE 786 ON READER SERVICE CARD

using the Power On Default feature(s).

using the enhanced feature(s).

For personal computers that
have been very, very good this year...



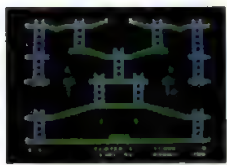
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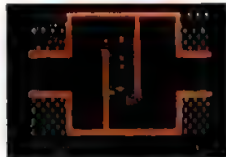
You have to defuse hundreds of bombs to save the Jupiter Command Center, but be careful. The bad guys are shooting live ones. Requires color display or TV, joystick optional.

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You have a little problem. Floodwaters have short-circuited your robot miners, and now they're running berserk. PCjr only. Requires color display or TV, joystick optional.

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Find and eliminate the evil Shadow. 128 rooms and all manner of ill-mannered creatures stand between you and your goal. Requires color display or TV, joystick optional.



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Dive for sunken treasure and live to tell about it. Maybe. PCjr only. Requires color display or TV, joystick optional.

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Serious Fun

PC Pool Challenges

If you don't have room for a pool table, this is the next-best thing. 1 to 4 players. Requires color display or TV.

Touchdown Football

Realistic football action. Call your own plays against an opponent or the computer as the crowd cheers you on. PCjr only. Requires either color display or TV, and joystick.

Trivia 101: The Introductory Course

5,000 trivial questions in more than 200 trivial categories. Up to 14 players (or teams) compete against each other and the clock. Requires color display or TV.

TV and Cinema 101: Trivia from Talkies to Trekkies

"What was the name of Pancho's horse on The Cisco Kid?" and 4,999 other infuriating questions. Requires color display or TV.

Casino Games

Try your luck at blackjack, poker or the slot machines with \$500 in "computer" chips. 1 to 4 players. Requires color display or TV.

Strategy Games

Computer versions of four popular board games: Checkers, Elusion, Battleship and Reversi. 1 or 2 players. Requires color display or TV.

CIRCLE 192 ON READER SERVICE CARD

This is NOT a simulated picture.
It's a real, live picture created
with PCjr ColorPaint (see
"Graphics Programs" above).

Graphics Programs

IBM PCjr ColorPaint

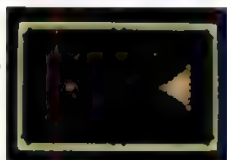
A program that helps you draw just about anything you can think (including the Christmas tree pictured below) in living, sparkling color. Very sophisticated, but very easy to use. PCjr only. Requires color display and mouse.

Animation Creation

Create colorful moving pictures on your computer. No knowledge of programming necessary. Requires color display or TV.

IBM

Personal Computer Software



SPECIAL ISSUE • DOT MATRIX LESS THAN \$800

Manufacturer	Model	Type	Price	Made in (country)	Dimensions (inches)	Weight (pounds)	Rated CPS	Effective CPS Default	Quality
Selko Instruments USA, Inc.	DPU-40	Thermal	\$125	Japan	1.8x8.3x4.7	0.9	24	13.6	N/A
Cal-Abco	Legend 880	Impact	\$279	Japan	4.3x15.5x13.0	10.8	80	52.3	14.9
Centronics	GLP	Impact	\$299	Japan	2.8x13.1x7.5	6.6	50	29.0	12.2
Saikosha	GP-550	Impact	\$299	Japan	4.5x15.5x12.0	12.0	50	30.3	15.7
Cal-Abco	Legend 1200	Impact	\$339	Japan	4.1x15.6x13.1	17.2	120	60.6	19.7
Okidata Corp.	Microline 82A	Impact	\$349	Japan	5.2x14.2x12.9	19.9	120	80.3	N/A
Personal Micro Computers	DMP-85	Impact	\$395	Japan	4.9x15.7x11.3	8.0	120	67.7	42.1
Smith Corona	D100	Impact	\$395	Japan	5.0x16.7x13.4	18.7	120	66.4	43.2
Mannesmann Tally	Spirit-80	Impact	\$399	Japan	4.9x14.8x11.6	11.0	80	49.3	14.7
Star Micronics, Inc.	Gemini 10X	Impact	\$399	Japan	5.8x15.2x12.4	15.4	120	59.5	20.6
Epson America, Inc.	RX-80	Impact	\$399	Japan	4.2x14.7x11.9	11.2	100	49.3	16.1
IBM Entry Systems Division	PC Graphics Printer	Impact	\$449	Japan	4.2x14.7x12.0	12.0	80	44.8	44.8
Hewlett-Packard	Thinkjet	Ink jet	\$495	USA	3.5x11.5x8.1	6.0	150	70.0	76.3
Diablo Systems, Inc.	P10 I	Impact	\$499	Italy	6.5x16.3x12.6	20.5	83	63.9	12.7
Panasonic	KX-P1091	Impact	\$499	Japan	4.5x13.9x11.3	14.6	120	61.6	16.7
Olympia	Electronic Compact NP	Impact	\$499	Germany	4.7x15.9x11.8	14.7	165	80.3	24.1
Inforunner	Riteman Blue Plus	Impact	\$499	Japan	2.9x14.0x10.5	11.0	140	75.6	23.9
Micro Peripherals Inc.	"S"printer	Impact	\$595	USA	7.0x18.0x14.5	16.0	160	78.5	N/A
Epson America, Inc.	FX-80	Impact	\$599	Japan	4.5x18.8x15.5	16.4	160	62.7	43.1

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters;

Font Name	Point Size	DBA	DBA	DBA	Font Style	Point Size	Width (inches)	Type Pitches	Font Style	Font Style	Font Style	Font Style
N/A	N/A	69.0	68.5		RP	R	3.1	16.5	—	—	N/A	N/A
Emphasized, double strike	N/A	75.0	74.0		UT,RSS	R	9.5	5,8.5,10,17	H,V,U,S	LH,FL,HT,VT	N/A	1/216
Near letter quality	60.0	75.0	74.0		RSS,PFR(O),RP(O)	R	9.5	5,8.5,10,17	H,C,U,S	LH,FL,HT,VT	N/A	1/216
Bold, correspondence quality	60.0	72.0	71.0		UT,RSS	R,B	9.5	5,8.5,10,12,17	H,V,C,U,S	P,LH,FL	N/A	1/120
Bold, emphasized	50.0	80.0	79.0		UT,RSS,RP	R	9.5	5,8.5,10,12,17	H,V,U,S	P,LH,FL,HT,VT	N/A	1/216
N/A	87.0	82.0	81.0		UT(O),PFR,RP(O)	R,B	9.5	5,8.3,10,16.5	—	LH,FL,VT	N/A	1/144
Boldface	N/A	82.0	81.0		BT,RSS	R	9.5	5,8.5,10,12,17	H,U	P,LH,FL,HT,VT	N/A	1/144
Condensed emphasis	63.0	76.0	75.0		BT,RSS,RP(O)	R	9.5	5,8.3,10,12,16.7	H,V,U,S	P,LH,HT,FL	1/120	1/144
Emphasized, double strike	64.3	78.0	77.0		UT,RSS	R	9.5	5,8.5,10,17	H,V,U,S	LH,FL,HT	N/A	1/216
Double strike, emphasized	64.6	85.0	84.0		PFR,RP	R	9.5	5,8.5,10,12,17	H,V,U,S	LH,FL,HT,VT	N/A	1/216
Double strike, emphasized	N/A	74.0	73.0		UT,PFR	R	9.5	5,8.5,10,12,17	H,V,U,S	LH,FL,HT,VT	N/A	1/216
Double strike	66.0	78.0	79.0		UT	R	9.5	5,8.5,10,16.7	H,V,U,S	LH,FL,HT	N/A	1/216
Emphasized	<50.0	<60.0	<60.0		BT,PFR	R	9.5	6,10.7,12,21.3	H,U,S	FL,HT	N/A	N/A
Emphasized	58.0	77.0	78.0		BT,RSS	F,R	9.5	5,8.5,10,12,17	H,V,U,S	LH,FL,HT,VT	N/A	1/216
Unknown (No documentation)	N/A	84.0	83.0		UT,RSS	R	9.5	10,12,15	H,C,S	LH,FL,HT,VT	N/A	1/216
High density	N/A	76.0	75.0		BT,RSS	R	9.5	5,6,8.5,10,12,17	H,C,U,S	C,LH,FL,HT,VT	N/A	1/216
Double strike, bold	N/A	88.0	87.0		UT(O),PFR	R	9.5	5,8.5,10,12,17	H,V,U,S	J,C,LH,FL,HT,VT	N/A	1/216
N/A	N/A	78.0	77.0		UT,RSS	F,B	9.5	5,6,7.2,7.5,8.5,10,12,14.4,15,17	—	LH,FL,HT,VT	N/A	1/8
Emphasized	N/A	82.0	81.0		UT(O),PFR	R	9.5	5,8.5,10,12,17.2	H,V,U,S	P,LH,FL,HT,VT	N/A	1/2164

AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required, G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge, CL=Cloth, CA=Carbon; I=Ink jet refill, T=Thermal paper. **Front Panel Controls:** O=On/Off line, F=Form feed, L=Line feed; FL=Combined form and line feed, E=Error message and correction; P=Power-on settings. **# Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary. (O)=Optional.

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your business better
than it's ever been run before."**



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*It Triggers Actions To Make
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Expert Consultants In Your Computer.

SPECIAL ISSUE • DOT MATRIX LESS THAN \$800

Manufacturer	Model	Alternate Characters	IBM PC Compatibility	Graphics Compatibility	Other Printer Compatible	Buffer Size (Bytes)	Ribbon or Refill Type	Ribbon or Refill Cost	Front Panel Controls
Seiko Instruments USA, Inc.	DPU-40	FL	L	N/A	—	0	T	\$2.10	L
Cal-Abco	Legend 880	AC	L	G	Epson	132	C,CL	\$9.50	O,L,F
Centronics	GLP	—	L,H,C	D	—	100	C,CL	N/A	O,L,E,P
Seikosha	GP-550	FL	L	G	—	0	C,CL	\$14.95	O,L,F
Cal-Abco	Legend 1200	FL	L,C	D	Epson	0	C,CL	N/A	O,L,F
Okidata Corp.	Microline 82A	FL	L	G(O)	—	256	S,CL	\$3.00	O,L,F,P
Personal Micro Computers	DMP-85	FL	L	G	—	0	C,CL	N/A	O,L
Smith Corona	1110H	FL,AC	L	G	Epson	132	C,CL	\$16.95	O,L,F,E,P
Mannesmann Tally	Spirit-80	AC,FL	L	D	Epson	N/A	C,CL	\$8.95	O,L,F
Star Micronics, Inc.	Gemini 10X	FL,DL	L,H,C	D	—	0	S,CL	N/A	O,L,F,P
Epson America, Inc.	RX-80	FL,AC	L	D	—	130	C,CL	\$14.00	O,L,F,P
IBM Entry Systems Division	PC Graphics Printer	AC	L,H,C	D	—	132	C,CL	N/A	O,F,L
Hewlett-Packard	Thinkjet	FL	L,C	D	—	1,024	I	\$7.95	O,L,F
Diablo Systems, Inc.	P10 I	FL,DL	L,H,C	D	Epson FX-80	1,536	C,CL	N/A	O,F
Panasonic	KX-P1091	FL,DL, AC	L	D	Epson RX-80	1,024	C,CA	N/A	O,L,F,E
Olympia	Electronic Compact NP	FL,DL,	L,C	D	—	2,048	C,CL	N/A	O,FL,P
Inforunner	Riteman Blue Plus	AC	L,H,C	D	Epson RX-80	130	C,CL	\$8.50	O,L,F,P
Micro Peripherals Inc.	"S"printer	FL,AF	L	G	—	4,096	C,CL	N/A	O,L,F
Epson America, Inc.	FX-80	FL,DL, AC	L	D	—	2,048	C,CL	N/A	O,L,F,E,P

Paper Feed: UT—Unidirectional tractor; BT—Bidirectional tractor; RSS—Roller, single sheet; RSF—Roller, sheet feeder; PFR—Pin-feed roller; RP—Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible; (3.0)=DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary. (O)=Optional.

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AST MonoGraph Plus (Lotus Compatible)	595.00	495.00
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Microsoft® Serial Mouse	195.00	139.00
Plantronics Color Plus (Symphony Compatible) ...	560.00	389.00
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Max-12 Amber Monitor ...	249.00	189.00
HX-12 Hi-res RGB Monitor ..	895.00	524.00
SR-12 Super Hi-res RGB Monitor w/Scan Doubler ..	1048.00	843.00
PTI Datasheet Power Supply ..	359.00	329.00
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Ashton-Tate dBase III	\$ 895.00	\$ 449.00
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CYMA Shoebox Acctg Pkg ...	395.00	315.00
Human Edge Sales Edge	250.00	198.00
Microrim Inc. R:base 4000 ...	495.00	315.00
Microsoft® Multiplan™	195.00	139.00
Multi Tool™ Word	375.00	249.00
Multi-Tool™ Word with Mouse	475.00	298.00
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C Compiler	500.00	349.00
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Cobol Compiler*	700.00	518.00
Sort Facility*	195.00	148.00
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Memorex 3½" Diskettes	89.95	49.00
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SPECIAL ISSUE • DOT MATRIX LESS THAN \$800

Manufacturer	Model	Type	Price	Made in (country)	Dimensions (inches)	Weight (pounds)	Rated CPS	Effective CPS	Quality
Micro Peripherals Inc.	Printmate 99	Impact	\$599	USA	6.5x16.0x10.5	15.0	100	51.5	36.0
Okidata Corp.	Microline 92 (Plug 'n' Play)	Impact	\$599	Japan	5.2x14.2x12.9	19.9	160	90.8	29.5
Okidata Corp.	Microline 92 (Standard)	Impact	\$599	Japan	5.2x14.2x12.9	19.9	160	90.9	30.0
Dataproducts	SPG-8010-2	Impact	\$649	Japan	4.9x16.7x13.6	18.7	180	82.2	5.4
Facit Data Products	4511	Impact	\$650	Japan	4.9x16.5x13.4	19.0	158	93.3	33.5
Texas Instruments, Inc.	850	Impact	\$659	USA	5.0x16.2x13.0	15.0	150	95.9	18.1
Diablo Systems, Inc.	P12	Impact	\$699	Italy	6.9x16.3x13.0	20.5	150	61.1	31.1
Centronics	H-80	Impact	\$699	Japan	5.6x15.7x12.5	17.5	140	70.4	24.1
Practical Automation	8-PLP	Impact	\$728	USA	6.0x17.1x13.0	19.5	275	136.0	N/A
Smith Corona	D300	Impact	\$795	Japan	6.4x24.8x14.4	39.6	120	107.9	22.1
Star Micronics, Inc.	Delta 15 PC	Impact	\$795	Japan	5.8x21.3x12.4	22.5	160	76.3	37.9
C. Itoh	8510SP	Impact	\$795	Japan	5.4x16.5x11.7	19.6	180	86.3	N/A

Manufacturer	Model	Characters	IBM PC Compatibility	Printer Control	Other Printer Compatible	Characters per Line (bytes)	Ribbon Type or Heat Type	Ribbon or Heat Cost	Front-Panel Controls
Micro Peripherals Inc.	Printmate 99	—	L	V	—	1,024	C,CL	\$12.00	O,FL,P
Okidata Corp.	Microline 92 (Plug 'n' Play)	FL,AC	L,H,C	D	—	256	S,CL	\$3.00	O,L,F,P
Okidata Corp.	Microline 92 (Standard)	DL,FL	L	G	—	256	S,CL	\$3.00	O,L,F,P
Dataproducts	SPG-8010-2	DL	L	G	Epson	2,048	C,CL	\$11.95	O,L,F,P
Facit Data Products	4511	—	L,H,C	D	—	2,048	C,CL	N/A	FL,P
Texas Instruments, Inc.	850	DL	L	D	—	256, 4,096(O)	C,CL	\$12.00	O,L,F,P
Diablo Systems, Inc.	P12	FL,DL	L,H,C	D	Epson FX-80	2,048	C,CL	N/A	O,F,P
Centronics	H-80	DL,AC	L,C	D	—	8,192	C,CL	N/A	L,F,E,P
Practical Automation	8-PLP	—	L	—	—	192	C,CL	N/A	O,L,F,E,P
Smith Corona	D300	FL,AC	L	D	—	2,048	C,CL	N/A	O,L,F,E,P
Star Micronics, Inc.	Delta 15 PC	FL,DL	L,H	V	—	8,192	S,CL	\$2.00	O,L,F,E,P
C. Itoh	8510SP	FL	H,L,C	D	—	2,048	C,CL	N/A	L,F,P

	Rate DPA	DPA	DBC	Paper Feed	Paper Source	Line (inches)	Line Feeds	Printing Features	Formatting Features	Line Increment	Line Increment
Serif font	70.0	84.0	83.0	BT,RSS, RP(O)	B	9.5	5,10,12,17	C,U	FL	N/A	N/A
Correspondence quality	67.0	75.0	74.0	UT(O), PFR, RP(O)	R,B	9.5	5,8.5,10, 17	H,V,C,U, S	LH,FL, HT,VT	N/A	1/144
Correspondence quality	67.0	75.0	74.0	UT(O), PFR, RP(O)	R,B	9.5	5,8.5,10, 12,17	H,V,C,U, S	LH,FL, HT,VT	N/A	1/144
Ltr. qual., emph., doub. strike	65.0	79.0	78.0	BT,RSS	R	9.5	5,8.5,10, 12,17	H,V,C,U, S	P,J,LH,FL, HT,VT	N/A	1/144
Boldface	<65.0	78.0	77.0	UT,RSS, RP(O)	R	15.0	5,8.5,10, 12,17	H,V,C,U, S	P,LH,HT, VT	1/200	1/144
Enhanced, emphasized, double	62.0	78.0	77.0	UT,RSS, RP(O)	R	9.5	5,8.7,10, 16.7	H,V,U,S	LH,FL, HT,VT	N/A	1/216
Correspondence quality	58.0	79.0	78.0	BT,RSS	F,R	9.5	5,8.5,10, 12,17	H,V,C,U, S	LH,FL, HT,VT	N/A	1/216
Correspondence quality	<60.0	80.0	79.0	UT,RSS	R	10.0	5,8.5,10, 12	H,V,C,U, S	LH,FL, HT,VT	N/A	1/180
N/A	62.0	81.0	82.0	BT,PFR	F,B	9.5	5,8.5,10, 16.5	—	FL,HT,VT	N/A	N/A
Near letter quality	63.0	72.0	71.0	BT,RSS	R,B	15.0	5,6,8.3,10, 12,16.7	H,C,U,S	P,LH,FL, HT,VT	N/A	1/144
Double strike	70.0	88.0	87.0	UT,RSS, PFR,RP	R,B	15.0	5,8.5,10, 12,17	H,U,S	LH,FL	N/A	1/216
N/A	64.0	82.0	81.0	BT,RSS	R	15.0	5,8.5,10, 12,17	H,V,C,U, S	P,J,C,LH, FL,HT,VT	N/A	1/144

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible; (3.0)=DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **# Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary. (O)=Optional.

Okidata Microline 84

The Microline 84 dot matrix printer comes in two flavors—plain and Plug 'n' Play. The second version is compatible with the IBM PC Graphics Printer.

Okidata rates both versions of the Microline 84 at 200 cps in draft mode and 50 cps in correspondence mode. Our benchmark test produced 98.7 and 21.3 cps, respectively, for the Plug 'n' Play

version, and considerably faster speeds (127.9 and 27.9 cps, respectively) for the standard version.

The Plug 'n' Play Microline 84 has most of the features you'd expect to find in a dot matrix printer: correspondence quality print, boldface, underlining, subscripts, superscripts, and a choice of character pitches, either 10 or 17 cpi (with a double-width option for each). However, it doesn't offer some of the character pitches, character sets, and other features found on the standard Microline 84. It also

lacks built-in alternate fonts.

When we tried to generate graphics with the PC-DOS GRAPHICS command, the printer produced a glitch. It spaces lines in increments of 1/144 inch. Since the IBM PC sends signals based on increments of 1/216 inch, fine, white, horizontal lines appear when we printed graphics. We didn't find this to be a serious defect, but we suspect that a graphics purist would be outraged.

The installation instructions were fine, but there's an error in the listings for the escape codes that produce the special effects. The manual lists the escape sequences in three ways: actual character (for instance, Esc-S-O), ASCII (27-83-48), and Hex (1B-53-30). Unfortunately, the manual lists ASCII 0 (the null character) instead of ASCII 48 (the zero key).

The standard version of the Microline 84 has many of the same features as the Plug 'n' Play version. It also has some extra ones, including 12- and 6-cpi pitches, and alternate character sets (mostly Greek letters and math symbols), foreign-language character sets, the capacity to download a character set, top-of-form setting by function code, and print suppression. The standard Microline 84 comes with overstrike and vertical-offset emphasized print features in addition to the correspondence quality mode. The quality of the correspondence mode is quite good, with only slight aliasing (the staircase effect usually noticed on poor-resolution displays) in some of the capital letters. The vertical-offset print, however, leaves the paper smudged, as if someone had touched it immediately after installing the ribbon.

Although the standard Microline 84 printer has a graphics mode, it is not compatible with IBM's. When we ran the graphics part of the test, the printer tried to dump the screen but failed. The attempt caused a paper jam, which produced a huge heap of torn paper.

As mentioned earlier, the standard version runs much faster than the Plug 'n' Play version. In fact, its 127.9-cps speed



Microline 84

Okidata Corp.
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(800) OKI-DATA, (609) 235-2600
List Price: \$1,099 (parallel), \$1,219 (serial)

CIRCLE 692 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Emphasized mode feature(s).
using the Correspondence mode feature(s).
using the Double strike feature(s).

is quite respectable when compared with those of other dot matrix printers in its price range (\$1,099).

The physical design of the Microline 84 leaves much to be desired. The parallel cable connects smack in the middle of the unit's back. This positioning can cause significant mayhem when you are feeding paper in from the rear. To solve the problem, you must feed the paper in through the bottom.

The spool ribbon bothered us. It's not that we mind getting our hands dirty. What annoys us is that the average life of a spool ribbon has three phases. Good quality lasts 15 minutes, marginal quality lasts two weeks, and then invisible print takes over. If you're going to shell out over \$1,000 for a printer, you don't want the print quality compromised by an ephemeral, \$4 ribbon.

Another complaint is that you have to unscrew the top of the printer to adjust the DIP switches. This operation is like having to pull out the engine of a car to change the spark plugs.

If IBM-compatible graphics don't mean anything to you, then by all means get your hands dirty on a standard Microline 84. However, if you need the graphics compatibility, you can get it on a comparable printer for about \$300 less.

—Gary Markman and Vincent Puglia

Mannesmann Tally MT-180

A rather boxy-looking machine, the Mannesmann Tally MT-180 appears to be a rugged, general-purpose dot matrix printer. It offers a number of useful features, including the ability to handle paper up to 15 inches wide, at a modest price.

This printer uses eight type pitches, ranging from 20 cpi (condensed) on up to 5 cpi, and it also does a nice-looking job in the correspondence quality mode, albeit at 26.5 cps instead of at almost 128 cps in draft mode. It prints subscripts, superscripts, underscored text, and graphics.

You can call up character sets for several foreign languages including German, French, and Spanish. And it claims enough punch to print through three-part business forms. The character set, however, skips a big chunk of the high-order IBM ASCII set.

The MT-180's programmable, nonvolatile memory establishes and changes the default settings. To find out what the current settings are, you simply press a button on the front panel to print them out. If you don't like one or more, another simple

command brings up a menu, and you give it yes/no answers as it asks about each parameter. Parameters include such items as the character sets for foreign languages, the buffer size (up to 2K), and even whether you want to use the printer with a serial or parallel port on your PC.

The tractor feed on the MT-180 seemed especially finicky, and it had a tendency to lose the paper out of one tractor or the other. The problem seemed to be a matter of alignment of the paper feeding in, but several efforts to readjust the spacing and



MT-180
Mannesmann Tally
8301 S. 180th St.
Kent, WA 98032
(206) 251-5500
List Price: \$1,098

CIRCLE 744 ON READER SERVICE CARD

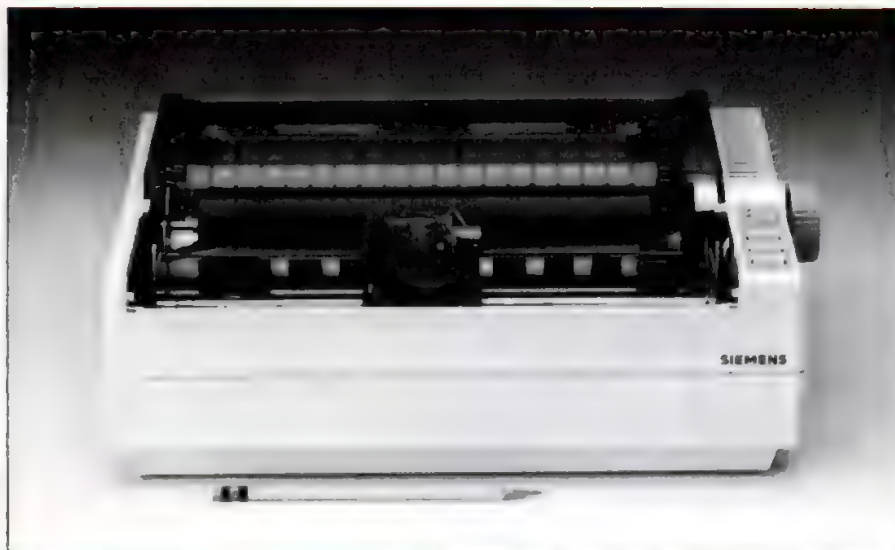
using the Power On Default feature(s).
using the corres qual feature(s).

paper alignment could not solve it.

I also ran into a problem running a test document in correspondence mode, although the same document had run with no problem in the data mode. The MT-180 printed part of the first page, and then the computer called a timeout and returned to the DOS prompt. Even installing the maximum buffer size did not help. A quick phone call to the manufacturer revealed that the problem was not too little buffer space but too much. The buffer should be set to the *minimum* size to keep the com-

puter from getting bored and wandering off in the middle of a job. The man on the phone knew exactly what the problem was even before I finished describing the symptoms. That prompts the question, if Mannesmann Tally is familiar with the problem, why hasn't it been fixed—or at least spelled out in the manual to save the user the cost of a call?

Generally, however, the documentation was quite adequate, and, overall, the MT-180 came off looking like a winner. —Jim Forney



PT-88

Siemens Communications Systems
5500 Broken Sound Blvd.
Boca Raton, FL 33431
(305) 994-8100

List Price: \$895

CIRCLE 742 ON READER SERVICE CARD

using the Power On Default feature(s).

using the double strike feature(s).

Siemens PT-88

Siemens Communications Systems has joined another well-known company in setting up shop in Boca Raton, Florida. And perhaps it's just a coincidence, but the company's new street address on Broken Sound Boulevard is perfect for its PT-88 printer; this silent ink jet printer has indeed "broken sound."

The PT-88 performs much like a typical dot matrix printer. It uses the same control codes as an Epson, and offers compressed, expanded, emphasized, underlined, and double-strike modes. You can print superscripts and subscripts. The PrtSc key works for screen prints. If you have loaded GRAPHICS.COM, it even does graphic screen dumps.

But the PT-88's most impressive feature is that it does all this in a whisper. Sliding your hand back and forth on a sheet of paper makes as much noise as the PT-88 does while it's printing. The noisiest part of the printer is the paper feed; it makes a slightly audible noise as it cranks the paper up each line. As a result, the PT-88 has one of the best noise ratings in this survey.

Although the printer was easy to set up, the written instructions didn't help much. Reviewing this machine taught me that Japanese companies do not have a lock on inscrutable documentation; German-to-English translations can create equally obfuscated manuals. Unfortunately, the problems go beyond language. The unpacking instructions tell you to remove items that are not there, a difficult task at best. Furthermore, the sequence given is nearly impossible to follow. You just have to gird your loins and remove the shipping restraints in whatever sequence works. (It's also a good idea to ignore the manual's advice to use a screwdriver on the clamps that hold the cover down; your fingers are more than sufficient.)

The manual contains almost all the information you need; you just have to dig

for it. Printer codes are listed in a reference section in ASCII order, not on a chart, and no one bothered to translate the switch-setting table from the original German. So if you want Zeichensatz 1, set Schalter 1 to On; it should be Off for Zeichensatz 2. You also get to decode what Zeilenvorschub and Papiervorschub mean.

Nonetheless, this printer was absurdly easy to set up. All I had to do was take off the shipping restraints, plug it in, have it perform its "wash out" procedure, and it was ready to zip through its self test. If I hadn't tried to follow the manual so carefully, the entire process could have been accomplished in a few minutes.

As the print samples show, the PT-88 features good, but not excellent, print quality. The double-strike mode seemed to produce the best quality type. For optimum performance, you really should use special ink jet printer paper. My tests used a good-quality, 20-pound paper, but the PT-88's ink drops tended to "bleed" with the grain of the paper. As a result, the top of a capital O looked a bit like Sluggo after he has seen a ghost; the dots became tiny lines standing on end. This bleeding is only a minor problem; even with plain paper the results are highly readable and well-suited for drafts. Print quality should be even better on special ink jet paper.

This solidly built printer produces its print at 70.4 cps in draft mode and 28.3 cps in double-strike mode. And it does so in near silence. So, if you are looking for a dot matrix printer for patron use in a public library, or even if you just want to keep the decibels down in your office, the PT-88 may be just what you need.

—Alfred Poor

Facit 4512

If you yearn for the days of printers that are difficult to set up and operate, here's some good news: The Facit 4512 is guaranteed to challenge your skill and patience. And its combination of parallel and serial interfaces is sure to double your

pleasure, or, more likely, your pain.

You could probably adapt the 4512 to work with a variety of different computers, but your task will be simple only if you own one of the few that use a 110-baud serial interface. Yet, since sections of the manual specifically address the IBM PC, I decided to see just how well the 4512 works with the PC's more common parallel interface.

The manual warns parallel interface users not to connect pin 18 when using the IBM PC because the printer runs 5 volts at

40 mA through this pin. The PC grounds pin 18, so I connected pin 18 anyway, and the printer did not blow up.

That's just the beginning. You must set 20 switches on the back of the machine before you can print anything. Even after flipping what I believed to be a sufficient number of switches, the printer would not work. I had to make a few phone calls before I could find someone who could point out my mistake: I had skipped over a series of switches I thought applied only to the baud rate for a serial interface. How-



4512

Facit Data Products
235 Main Dunstable Rd.
Nashua, NH 03060
(603) 883-4157
List Price: \$995

CIRCLE 762 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Bold feature(s).

using the Emphasized feature(s).

using the Bold + Emphasized feature(s).

ever, turning on these switches tells the printer to use a parallel interface instead. (The manual does indicate this, but not very clearly.)

After making the correct DIP-switch settings, I still had problems. Every time the PC sent an initialization sequence to the printer (for instance, every time PC-DOS booted or a compiled BASIC program began execution), the printer went off-line. In this case, you must press the on-line button; otherwise the first print output fails with a timeout error.

The manual is not merely murky, it's downright frustrating. Although the appendix displays the complete IBM screen character set and indicates the appropriate DIP switch, the printer requires the correct ROM to be able to use them. The machine I tested apparently lacked the necessary ROM, since instead of printing the IBM screen characters, it produced block graphics similar to those from the original IBM PC printer.

Two DIP switches control the way the 4512 prints dot-addressable graphics. One

setting (possibly two) is compatible with the Epson and therefore the IBM printer. Printing a graphics display screen (with the PC-DOS GRAPHICS program loaded) produced results on two of the four possible settings. But the characters were twice as wide as they should have been, and they didn't line up on the vertical. And a ragged left margin on the screen display severely distorted the printed graphics.

The Facit 4512 produces its rather light default print quality at more than 100 characters per second. Using emphasized and bold print together improves readability, but slows the print rate all the way down to about 17 characters per second.

The positive side of the printer's versatility and complexity exhibits itself in the "hex trace" mode. If you turn on the 4512 while holding one of the rocker switches, it will print the hexadecimal values of every character and control sequence sent to the printer.

You'll want to avoid the Facit 4512 if you're looking for an easy-to-use printer that works right out of the box. But if you long for the challenge of getting a troublesome printer to work right, go ahead and try the 4512. Then, once you get the parallel interface working, try the serial one. The Facit 4512 won't bore you, but it's guaranteed to add a little frustration to your life. —Charles Petzold



P1340

Toshiba America, Inc.
Information Systems Div.
2441 Michelle Dr.
Tustin, CA 92680
(714) 730-5000
List Price: \$995

CIRCLE 756 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Proportional Space feature(s).

Toshiba P1340

The Toshiba P1340 dot matrix printer was the first I tested for this project, and it left me with little patience for lesser machines.

The simple and straightforward installation was aided by one of the better printer manuals I've seen. A glance at the page labeled "Quick Results from Your P1340 Printer" will get the experienced computer user up and running immediately. The novice will find all the necessary information in a nearby chapter. One well-drawn illustration shows how to thread paper through the machine.

The manual also offers easy-to-find command sequences for print features. And, with one exception, it fully explains them, too. The exception is the alternate-font feature, which the manual says requires the command Esc * C, where C is zero for the high-speed character set, one for the high-quality character set, or three for the proportionally spaced character set. All well and good, except that after trying to use this feature without success, a very careful reading of the instructions made me realize that the printer doesn't want ASCII zero, one, or three, it wants the ASCII character codes for zero, one, or three—that is, the numbers 48, 49, and 51. A minor complaint, perhaps, but potentially a frustrating hangup.

Another potential source of confusion concerns the way Toshiba achieves compatibility with the Qume Sprint 5. While the P1340 uses the Qume Sprint 5 language, Toshiba has made some compromises in accuracy. This leads to such quirks as the P1340 allowing you to adjust vertical line height in 1/48-of-an-inch increments, but then setting odd fractions (3/48) to the nearest 1/120 inch. The manual doesn't explain this very well, but it's probably best to ignore it anyway, since you are unlikely to notice the difference. In spite of these lapses, the manual has more good points than bad points.

Also on the plus side, I was more than a little impressed by the quality of the P1340's output. The 78.4-cps, default draft quality mode is reasonably readable to begin with, but the high-quality output, at about 40 cps, looks almost as good as daisywheel printing. If you look carefully, you can see the telltale signs of a dot matrix printer, but you do have to look.

Be aware that the P1340 is not completely without problems. It does not, for example, support the PC's high-order characters, but it also doesn't crash or hang up the way many printers do.

The P1340 comes with both a parallel and a serial connector. I tested the parallel version, which uses a standard IBM parallel cable. Either way, if you have the

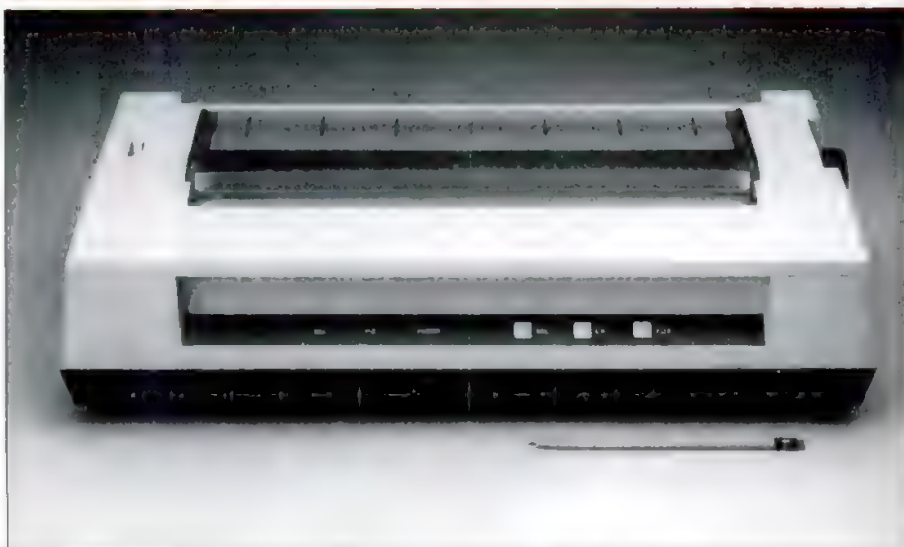
right cable, setting up the printer is mostly a matter of plug in and go. And, once started, this printer does its job quite nicely. —M. David Stone

C. Itoh 1550EP

The 1550EP is compatible with the IBM PC right off the shelf. But, more than that, its wide carriage, multiline print buffer, and faster print speed let it outshine the standard PC Graphics Printer. And it

doesn't sacrifice the special IBM graphics characters and ability to print a graphics screen.

The easy-to-set-up 1550EP is a wide machine because of its 15-inch carriage, but it's not as deep as most wide-carriage printers. I liked the way it looks. And I liked the way it printed; it was great to see the IBM line graphics and foreign-letter set print without DIP-switch adjustments, special control sequences, or dedicated software. The printer zipped along at more than 100 characters per second in PC's



PC GRAPHICS

1550EP

C. Itoh Electronics
5301 Beethoven St.
Los Angeles, CA 90066
(213) 306-6700

List Price: \$995

CIRCLE 763 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Double Strike feature(s).
using the Emphasized feature(s).
using the Emphasized Double Strike feature(s).

tests, and it has a snappy form feed.

The regular characters looked good, better than on the IBM Graphics Printer, but the lower parts of the graphics characters weren't lined up well. The 1550EP prints some of these characters in two passes, since they extend down to the top of the next line. Unfortunately, however, the second pass of the 1550EP's printhead doesn't always hit the right spot. Successive lines of dot-addressable graphics show the same problem. The verticals on the line graphics may be off by as much as

the width of the line itself, and a long vertical line of these characters is crooked.

On the plus side is the fact that the 1550 EP can print a graphics display with the simple Shift-PrtScr key combination after the PC-DOS GRAPHICS program has been loaded.

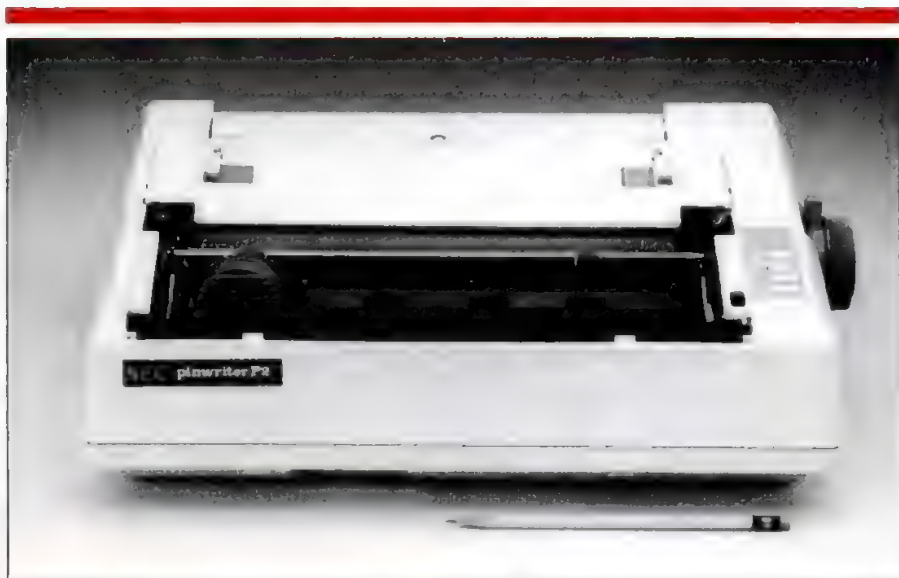
The suffix of the 1550's model number is crucial; so be careful when following the manual. The basic model number is 1550, which is what was printed on the back label of the printer I tested. It came with a 1550 S/SC manual. (The S and SC are two

different models; the C indicates that that model prints color.) C. Itoh also makes a 1550BP, which has an IBM attachment. But the machine I tested (according to the C. Itoh staffer who walked me through a quiz of certain physical aspects of the machine) was the 1550EP, which is hard wired to be IBM compatible. So the S/SC manual delivered with the machine did not include the correct control sequence descriptions, since the normal 1550 is not IBM compatible. However, if you have a copy of the IBM PC *Guide to Operations* manual with a printer insert, or any of the technical reference manuals for the IBM PC, PC-XT, or PCjr, you have all the codes you need.

There are some subtle differences between the IBM printer's and the 1550 EP's responses to control sequences. Because the 1550EP's 2K print buffer is not line oriented, a carriage return will not print, as it will on the IBM printer. But the 1550EP performed all the standard and familiar IBM printer sequences well, including boldface, emphasized, compressed, double width, underline, subscript, superscript, and so forth.

C. Itoh assured me that it will ship the correct manuals when the 1550EP becomes available. But, again, be sure you're getting the correct model. If you're buying a 1550 and you want complete IBM compatibility, take home the EP.

—Charles Petzold



P2 Pinwriter

NEC Information Systems, Inc.
144 Massachusetts Avenue
Boxborough, MA 01719
(617) 264-8000

List Price: \$875

CIRCLE 686 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Pica HS (Default) feature(s).
using the Pica HD feature(s).
using the Pica Near Letter Quality feature(s).

NEC P2 Pinwriter

The NEC P2 Pinwriter is an impressive new machine, but it may turn off potential buyers with its penny-wise, pound-foolish approach.

For starters, NEC wraps a couple dozen printed sheets of illustrations on IBM-size paper in shrink wrap and calls that the manual—no binder, no index. A 20-page addendum is on slightly different-sized paper with the binder holes out of register. Also, the printer was shipped with a rubber-roller friction feed platen as the only

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For more information, just write C. Itoh Digital Products, Inc., 19750 South Vermont Avenue, Suite 220, Torrance, CA 90502.

Or phone toll free 1-800-423-0300. In Massachusetts, call 1-617-769-8770.

C. Itoh
DIGITAL PRODUCTS



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CIRCLE 166 ON READER SERVICE CARD

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files at the same time. Handle
up to 400 fields. And sort it
all out in a hurry. It's everything
I need to keep my lists in order.

"And if your inventory is
anything like mine, you'll
appreciate the programming
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do conditional processing.
Post transactions. And update
multiple files from one input
form.

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power, the real gift is that it's
so easy to use.

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tutorial makes R:base a snap
to learn. And now, there's a new
applications diskette with
ready-to-use mailing list, inven-
tory management, and fore-
casting applications.

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our personal computers in
plain English. Clout also
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data is stored, and can
search for it across

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end up out in the cold!"



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Requires 256K of memory. Runs on MS-DOS and PC/DOS
operating systems. CP/M-80 requires 64K.

CIRCLE 428 ON READER SERVICE CARD



paper advance—no pin feed, no tractor. NEC relented recently; it now includes a tractor in the list price.

The single-digit LED that indicates print modes and features is, in effect, a real crusher. It's mounted not on the top or front panel, but on the main circuit board at the very bottom of the printer. You can see it only by standing directly over the unit and peering down through the see-through cover, and if the printhead is in the middle of the carriage, you'll need X-ray vision to read it.

Despite NEC's apparent best efforts to make you dislike its optimistically priced (\$875) machine, it incorporated enough desirable features to make you appreciate and possibly lust after a Pinwriter. They include eight built-in typefaces (three of them almost letter quality), a ninth downloadable character set, automatic roll-in of single sheets of paper, near-perfect imitation of the IBM Graphics Printer, automatic perforation skip, eight international character sets, a choice of slashed or unslashed zero, and even an option to convert normal data to a hexadecimal printout.

The 18-pound, 16-inch-wide P2 Pinwriter is the 80-column half of the P2/P3 family. The name is an obvious play on NEC's run-forever line of Spinwriter thimble printers.

Setting up is no problem. The sizable IBM interface cartridge and the ribbon cartridge (\$12) snap right in. You also have to check, and possibly adjust, two sets of DIP switches hidden inside the printer next to the font indicator. Holding down the Line Feed button while powering up runs a self-test and prints six of the available character sets.

NEC's 18-pin printhead offers a range of speeds that vary with print quality. The highest speed (Pica HS mode) is too coarse for anything except rough listings. Compared to those produced by an Epson in draft mode, the characters appear more as dots and white spaces than fully formed characters. The next step up the print-quality scale (Pica HD and Elite HD) is a significant improvement but at the ex-

pense of a significant loss of speed.

The trio of double-pass, near-letter-quality fonts; Pica NLQ, Elite NLQ, and proportionally spaced NLQ offers superb letter quality. It's a close call, but I'd say the NEC near-letter-quality mode was slightly better than the impressive correspondence quality of the Okidata 92-93 series.

NEC's 17-cpi condensed character set will benefit only ophthalmologists. Even with a brand-new ribbon, lowercase characters are mostly rumors. If wide spreadsheets are your forte, try a few at 17 cpi before you give the dealer your credit card.

The built-in fonts can be selected by a set-up string sent from the PC or by the top-cover switch. You can select elongated characters (5 cpi) only by using a signal, not a switch. Graphics modes allow vertical spacing in 1/216 of an inch (IBM Graphics Printer compatible) or 1/240 of an inch.

Hardware options include a handy single-sheet insertion guide (\$15), a bi-directional tractor (\$150), and a sheet feeder (\$350). Paper feeds in only from the rear. The penny-pinching location of the font indicator and DIP switches is where a bottom-feed slot should be but isn't.

The manual is a bit less hostile to users than the infamous Spinwriter manuals, but nonexperts must still check their insurance and don life jackets when venturing beyond the title page. The failure to cross-reference functions that can be performed by setting printer switches, manipulating the circuit-board DIP switches, or sending set-up strings over from the PC is particularly annoying. Is an index too much to ask for?

If the Pinwriter were to cost \$100 to \$200 less, included a real manual, and had the font indicator and DIP switches some place where you wouldn't need a topographic map to find them, this machine could be the class act of the low- to mid-price, narrow-carriage market. Flaws and all, it's worth considering.

—William K. Howard

PrintMate 150A

PrintMate 150A was designed for people who own a computer because it adds a modern touch to their homes. The styling of this printer will enhance that effect. The wide front panel includes a 12-key numeric pad, smoked plastic conceals all those ugly mechanical things, and there are no obtrusive platen knobs protruding from the side.

At first encounter, the PrintMate 150A is quite striking. But as we all know, inner beauty must complement physical appearance. A printer's inner beauty is reflected in its ease of use, its speed, and the quality of its print. As I continued to work with the PrintMate 150A, I came to look upon this as the Dorian Gray of printers.

Part of the problem is the manual. The text is right justified without micro-justification, so there are big, ugly spaces between words. Evidently the manual was printed from one of Micro Peripherals' own machines, and someone forgot to set it for correspondence quality.

"The manual is organized in a logical manner," it says in the introduction. That's a joke. Part of the instructions on how to set up is found in the Appendix, and the other part is in the middle of Chapter 3. The manual also instructed me to take apart the printer for the purpose of removing the head restraints, but I found they were missing!

Rubber feet hold the unit high enough so that paper can be fed into the bottom of the printer. Be aware, however, that the initial loading of the paper requires lifting the machine to access the bottom slot.

A single button functions as both a form feed and as a means to set top of forms, depending upon whether the select/deselect button is in or out. This takes some getting used to. In the beginning, it's just guesswork—either you've moved the paper to the next top of form, or you've just set a new one.

The 150A has selectable draft and cor-

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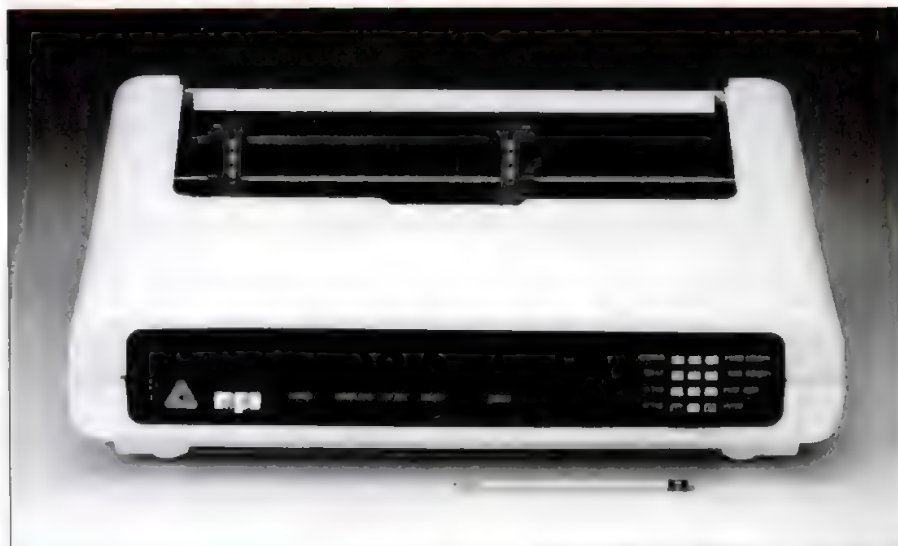
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responsiveness quality, but no specified double-strike or emphasized mode. Switching mid-line from elite to a smaller print causes overprinting of several characters. Although the manual discusses how the printer keeps track of where it is in a line, it provides no indication of how to fix the problem.

The keypad on the front panel lets you set tabs, form length, baud rate, vertical spacing, and whether or not you want correspondence quality. This is useful for people who routinely switch paper size or

computers, or who have difficulty making their software packages send out the right control sequences. (The keys play music when they're set correctly.) One key prints out a small report showing the rest of the key settings.

A battery backup keeps the key settings in printer memory even when power is shut off. It also retains software control settings. After directing the printer (from software) to print correspondence quality, I couldn't find the correct sequence to go back to draft. A foolproof way to reinitial-



PrintMate 150A

Micro Peripherals, Inc.

4426 South Century Drive

Salt Lake City, UT 84123

(800) 821-8848

(801) 263-3081

List Price: \$1,150 (including softswitch keypad)

CIRCLE 743 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Serif Font feature(s).

ize a printer is, of course, to turn it off and then on again. Not with this one. For the first time in my association with computers, I actually felt that there just may be a ghost in the machine. Since only the manual keypad settings are shown on the printed status report, it is possible to set something on this machine and not even be aware of it.

The print quality was mediocre, and the machine sounded more like the chattering of a daisywheel than a dot matrix model. None of the PC graphics tests worked.

MPI has a toll-free number, and the people there are very helpful. I was told the company has some brand-new software that makes the machine IBM PC-compatible. One program reportedly supports 40 different downloadable fonts, and another is capable of producing a graphics screen print from the PC. Even with new software, however, the poor print quality of the 150A leaves much to be desired when compared to its less-expensive competitors. —Charles Petzold

Omni 800 Model 855

Other than its name, there is nothing convoluted about the Texas Instruments Omni 800 Model 855 dot matrix printer. In fact, it offers both novices and experienced users the capability to do some fancy printing. The two features responsible for this phenomenon are the control panel and the three slots used for font modules.

At first glance, the control panel may intimidate you. Its array of 8 buttons and 12 indicator lamps consumes a healthy portion of the top cover. However, a closer look reveals that most of the buttons and lamps, such as those for form- and line-feeds, are standard on many printers. In addition, the Model 855 offers buttons to switch between draft and correspondence quality printing, and to select line spacing, character spacing, and font modules. Each selection appears on the appropriate indi-

The Brand NEW *Fancy Font 2* printed this ad on an Epson FX printer

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cator. Be warned, though, that the occasional unresponsiveness of the touch panel may require you to use more pressure than you might think necessary.

The Model 855's greatest strength lies in its ROM-cartridge font modules, which slip into the three slots at the front of the unit. Once the cartridge has been installed, you can access a font module either by pressing the touch button on the control panel or by sending the appropriate escape code sequence. Because the unit has the ability to select and deselect modules, documents can contain more than one font. True, you'd need a selection of font modules to make full use of the Model

The Texas Instruments 855 is like a blank check. Its worth depends on you.

855's capabilities, but, since they cost just \$40 a cartridge, that shouldn't be too much of a problem. The fonts range from Courier 10, the one used for PC's correspondence quality test, to Greek letters and math symbols. Thus, unlike most writers, the 855 slips easily between poems and technical writing.

The Model 855 printer comes with a standard Gothic font module and a limited character set in ROM. You can define and download other character sets if those aren't enough. The Model 855 also includes many of the standard features found in other dot matrix printers, such as compressed, expanded, boldface, and shadow print. Proportional printing is possible with the appropriate modules. You

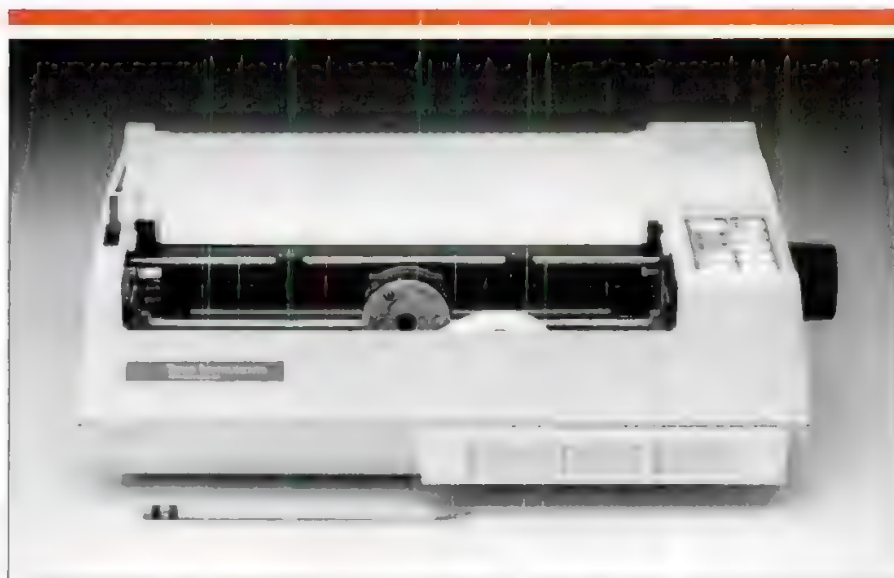
can justify copy through either your PC or the printer. The 855 provides two types of PC-compatible graphics—raster and mosaic—both controlled with escape code sequences.

Texas Instruments didn't stint on the documentation, either. The 855 comes with four documents: an operator's manual, a technical reference manual, a compatibility guide, and a quick-reference card. Although some information is duplicated, each manual serves a different purpose, is clearly written and adequately

illustrated, and provides numerous examples and explanations.

The operator's manual is geared to just-turn-it-on-and-print users. It includes installation and control panel information. The technical manual offers the escape code sequences, DIP-switch settings, and a number of appendixes. Both manuals possess indexes. The compatibility guide contains information for connecting the 855 to various computers and lists the software used during the testing procedure.

The TI 855 is like a blank check. Its



Omni 800 Model 855
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List Price: \$935

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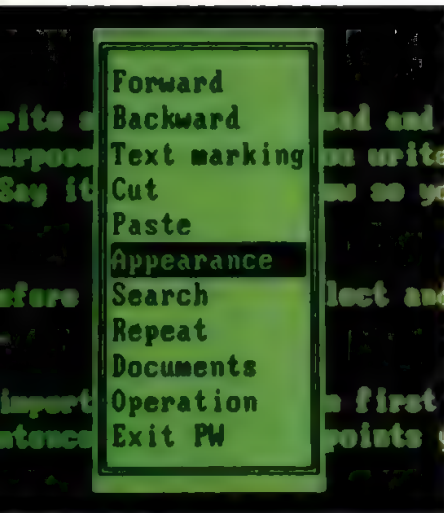
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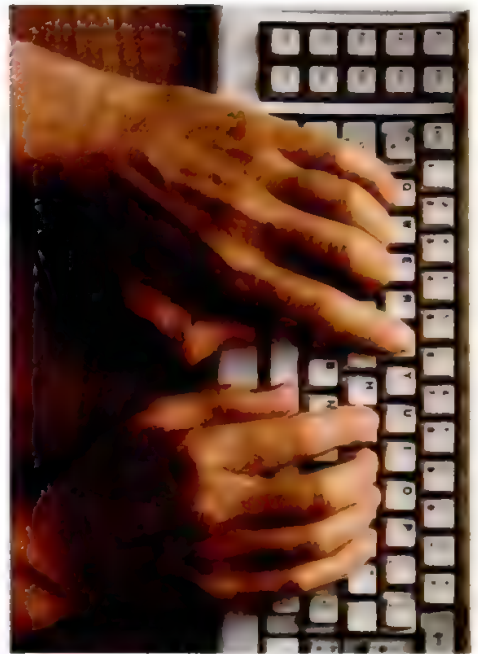
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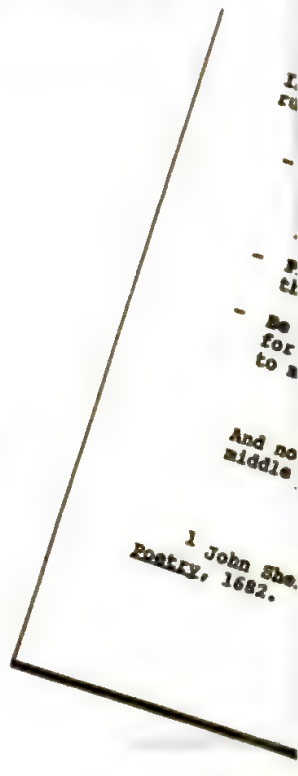
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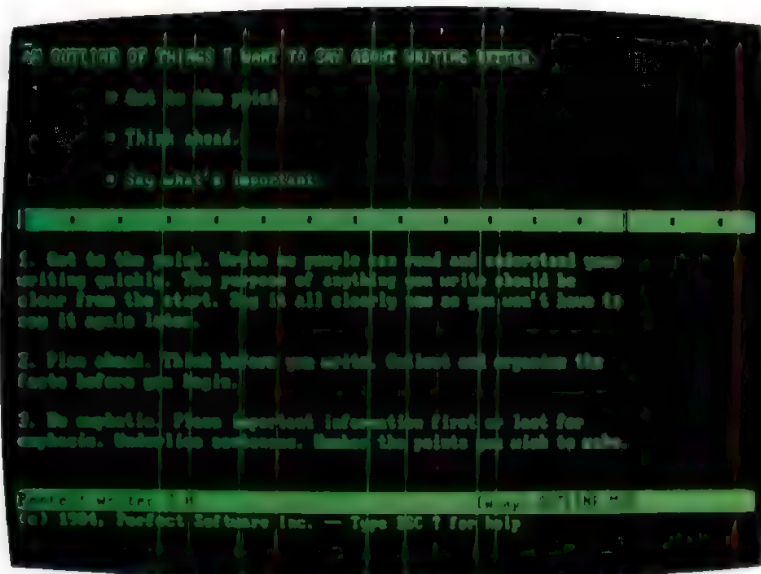
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worth depends on you. Novices can rely on its ease of use; experienced users will delight in capabilities not found in other printers. The 855 offers high quality and high performance at a reasonable price. —Vincent Puglia

Radix-10 PC

Though the Radix-10 PC offers plenty of features to satisfy a busy home or office user, I am not convinced this printer is

worth \$850. If you're considering buying this model, be sure to look at comparable Epson or Okidata printers before you whip out your credit card.

Getting the Radix-10 up and running doesn't require technical savvy. All you do is snap in the ribbon cartridge and connect the AC and parallel (or serial) interface cables. You can begin experimenting with the printer immediately by jumping to the manual's appendix of command sequences. Each control code is well documented with a description of its function

and a page reference for detailed explanations.

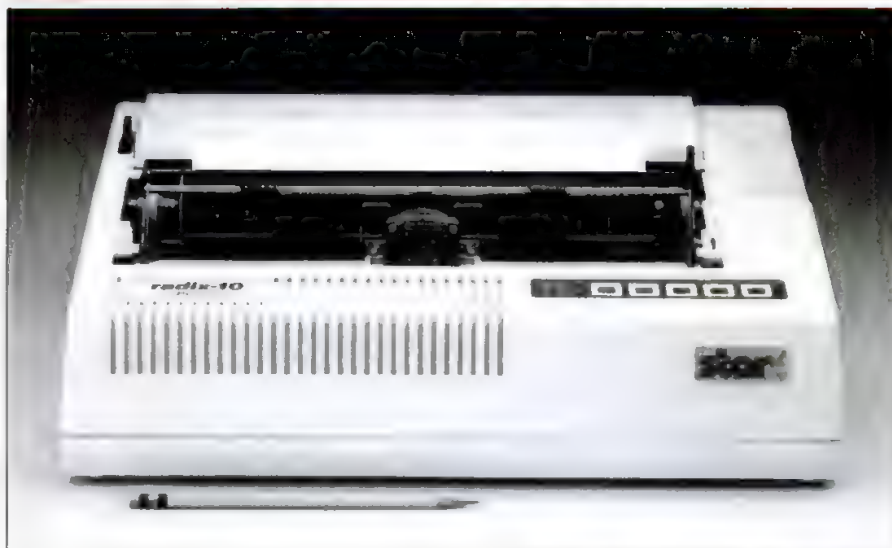
Condensed, elite, pica, condensed/expanded, and expanded pitches are available in combinations with underline, double strike, and emphasis for a wide variety of type styles with only a few quirky rules—one of which dulled an otherwise brilliant feature. The printer has an alternate character set called NLQ that is similar to standard characters, only darker. But it cannot be used with any other special feature except underlining. It is also not possible to use emphasized print outside of pica or expanded width. On the other hand, subscript and superscript may be used with all pitches except condensed/expanded. And proportional spacing may be used with any type style.

The Radix-10 can use perforated, roll, or single-sheet paper of varying thickness. There is an accessible adjustment lever to change the printer's head gap. The manual labor required to insert single sheets can be

The Radix-10 blends into the crowd of printers whose size is comparable to portable typewriters.

halved with the optional sheet feeder, which is operated from the front panel. You simply place a sheet of paper in the feeder (sorry, you can't stack it), press a button labeled Feed, and then marvel at how evenly it pulls the page to the first printing line. Nice touch.

The Radix-10 has no problems with the PC character set or with PC-DOS graphics, but it does not use all the same com-



Wq



Radix-10 PC
Star Micronics, Inc.
888 Washington St.
Dedham, MA 02026
(617) 329-8560
List Price: \$849

CIRCLE 793 ON READER SERVICE CARD

using the Power On Default feature(s).
using the emphasized feature(s).
using the double-strike feature(s).
using the emphasized and double-strike feature

mand sequences as the IBM PC Graphics Printer. Although I like the shape of the Radix-10's type styles better than IBM's

The regional technical-support person seemed friendly and well informed when I called.

or Epson's, the characters are not as dark as the ones the other printers produce. Using emphasized and double-strike commands can produce an acceptable letter-quality appearance, however.

We tested this printer at just under 90 cps in the default draft printing mode. This is certainly more than acceptable for home use but a far cry from Star Micronics's claim of 200 cps. And the letter quality printing I mentioned happens at only 27 cps. Good thing it has a large buffer memory (16K).

As for looks, the Radix-10 blends into the crowd of printers whose size and weight are comparable to portable typewriters. There's nothing especially flashy, sexy, or chic about this printer, it makes its presence known by clipping along at more than 80 decibels.

I found the documentation thorough and easy enough to understand, but it has the unprofessional look of photocopied pages folded and stapled together in the middle. The regional technical-support person seemed friendly and well informed when I called, with one amusing exception. I asked him about the smallest increment available for proportional spacing. First he thought I meant line height, and then he stated 1/216 of an inch several times.

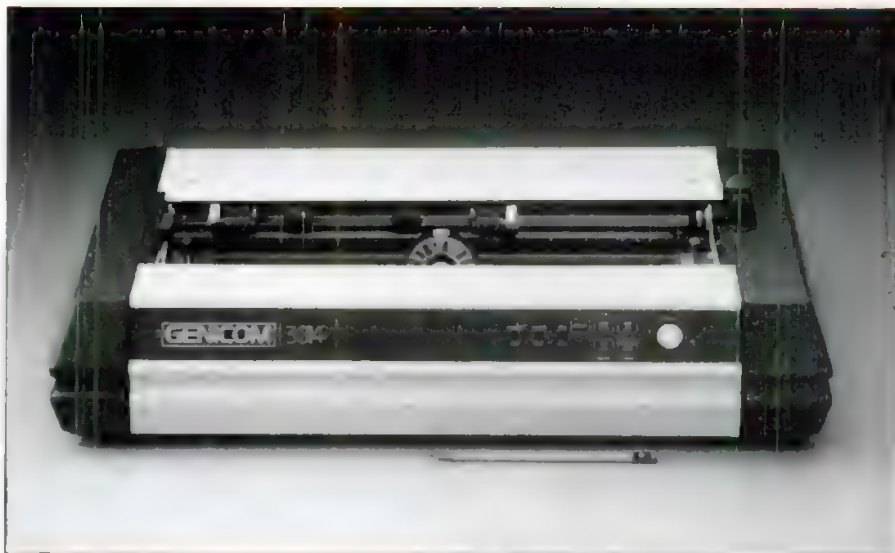
Then he rustled some papers, thought for a moment, and told me proportional spacing was not available on the Radix-10.

It is. I told him I was looking at a line of proportionally spaced type that I had produced on his printer in the test lab. But the list of command sequences in his documentation didn't show that that was possible. I read him the escape code from the appendix of my user's manual. "Well," he admitted, "I guess it does, then." Perhaps I should have asked if I could help him with anything else. —Phil Wiswell

Genicom 3014

Genicom bills itself as "the new company you've been doing business with for years." In fact, that's not a bad slogan for its 3014 printer.

Genicom is a chip off the old General Electric block, created when GE decided to get out of the printer business. The printer is the GE printer, but it's familiar for more reasons than that. It emulates not



3014

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CIRCLE 701 ON READER SERVICE CARD

using the Power On Default feature(s).



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SAMNA is available for IBM PC, XT, IBM-compatible, TI Professional, and DEC Rainbow microcomputers.

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only the Epson MX series with Grafrax, but also the Okidata Microline 84.

The 3014 is a breeze to set up. The hardest part is installing the ribbon cartridge (which is similar to but not the same as the one the Epson uses). This unpleasant job is somewhat easier when you use the separate ribbon guide, which comes with each ribbon and snaps down on the printhead. All you need to do is make sure you get the ribbon over the roller guides properly. The ribbon has a half-twist (a Möbius strip arrangement), so you use both sides, and presumably the ribbon wears more evenly.

The paper tractor is inside the case; it pushes the paper through the print area. The guides are easy to get at and adjust, and, although I had some misgivings about the design, the paper never jammed or misfed. This performance is impressive, especially when you consider the printer's high feed rate (7 inches per second).

The printer comes with both serial and parallel interfaces as standard features. I tested only the parallel connection, but the factory switch settings worked with the IBM PC straight out of the box. The front panel, from which you may select a variety of fonts, pitches, and form lengths, is programmable. You can access many but not all of these features through software.

I ran the 3014 in the Epson mode, which is how it came from the factory. It worked flawlessly. The printer is rated at 160 cps, and it managed about 115 cps in draft mode using the PC standard file. I was even able to print out graphic screen dumps.

You must use the front panel to access the 3014's NLQ (near-letter quality) font. This is a clean Gothic typeface. While not equal to that produced by a daisywheel, it is much better than what you get with Epson's emphasized mode. But you pay a significant penalty for this quality—reduced speed. The time trials for the NLQ font ran under 27 cps.

The manual is excellent. It explains

nearly everything clearly and simply, with few exceptions. Although more examples showing how to use the Escape codes would have been helpful, there are plenty of illustrations. The sections on how to emulate the Epson and the Okidata are each on different color paper; it's easy to find them. The appendixes cover a variety of technical details, including step-by-step directions on how to hook the printer up to specific microcomputer systems.

The main complaint I have about the 3014 is that it is noisy. All impact dot matrix printers make some noise, but this one produced more than most of the others, and at high frequencies. If you plan to sit near the 3014 while it's working, budget now for a soundproof enclosure or ear muffs.

The Genicom 3014 is a noisy but flexible printer, priced higher than many competing machines. If you must have compatibility with both Epson and Okidata in one printer, this one is worth a good look, but be sure to give it a listen as well.

—Alfred Poor.

Diablo P12 and P32

The P12 and P32 are dot matrix siblings from Diablo Systems. Despite the lower price of the standard carriage P12, the price of the wide carriage P32 version places the pair in the \$800 to \$1,199 class.—J.D.

Diablo P12

One of Diablo's first two dot matrix printers, the P12 is unfortunately plagued with a severe case of mediocrity. At \$699, the P12 is targeted as a heavy-duty printer for professional use. Its major feature is its correspondence quality (CQ) print mode, enabled either by a button on the operator panel, microswitch settings, or software commands. The CQ mode uses a 16 × 32 print matrix instead of the standard draft mode's 9 × 11 matrix, so it should produce superior print quality, but testing found it inferior to the emphasized double-

strike mode on Diablo's less-expensive model P10 I.

The initial print output from the P12 was so shockingly poor that I immediately called the manufacturer to express my disbelief, placing the blame on my own fallibility. "Why would the \$499 P10 I junior printer outperform Diablo's star?" I asked.

"Try the red lever for carbon copies" was the immediate reply from a personable Diablo spokesperson. "It'll adjust the impact."

Not having noticed the red lever, I went back to the documentation, but there was no mention of it. It may have been displayed in one of the technical illustrations, but the quality of the artwork was so muddled, I'd be hard pressed to say for sure. The manual, a stapled-together booklet full of typos and poor illustrations, looks homemade. You don't read it; you decipher it.

The lever adjustment did make some difference in print quality, but the muddled and fuzzy-looking characters were still far from my notion of correspondence quality. Often, they had no closure at the tops. The printing was also inconsistent, with parts of individual letters appearing exceptionally light and "dotted."

In addition to CQ, the Diablo P12 has underlining, double width, emphasized, double strike, subscript, and superscript capabilities. None of these features showed much improvement over the CQ mode, and some of them are not compatible with CQ. For instance, even if you have the CQ button engaged and the indicator light is on, a software command to use emphasized mode overrides the CQ setting.

The P12 has an adjustable tractor feed and can take fanfold paper through its rear feeder slot and single sheets through a front slot. As with the less-expensive P10 I, you don't have to disengage the fanfold paper to print a single sheet. Unfortunately, also like the P10 I, the fanfold paper insisted on re-entering the rear insertion slot once it had been printed. A simple

paper separator would help avoid these paper jams.

The P12 comes in two versions, an 80-column model and a 132-column model. Both come packed for shipping in a well-designed carrying box. At 20½ pounds, the machine builds strong forearms, but it can be transported.

The P12 is absolutely 100 percent PC-compatible for both graphics and character sets. You can set a DIP switch to provide Epson compatibility. Unfortunately, however, the graphics output was inconsistent and fuzzy. Solid areas had an unattractive "dot matrix" appearance about them.

The P12 is intended to be versatile. It supports seven national character sets, both American and international form lengths, and a respectable range of paper widths and lengths.

For its price, the Diablo P12 has a sparse look to it. The wiring under the hood doesn't look very neat, and silver burnish peeks through the printhead's cosmetic black paint. There are no bells, alarms, whistles, line feed, error messages, flashing lights, or other control "doodads." Nor is the P12 particularly fast. In draft mode it ran at 61.1 cps (the manufacturer overrates it at a ludicrous 150 cps), and in correspondence quality it ran at half the speed (31.1 cps)—no faster than the P10 I. And at 78 dB, the noise level of the P12 is slightly higher than that of many comparable dot matrix printers.

Even though I kept plugging away at it, the P12 was a disappointment after my favorable impression of the cheaper P10 I. Diablo intends the P12 to compete in the business marketplace with machines such as the notorious Epson FX-80, but I fear it's back to the dot matrix drawing board!

—Robin Raskin

Diablo P32

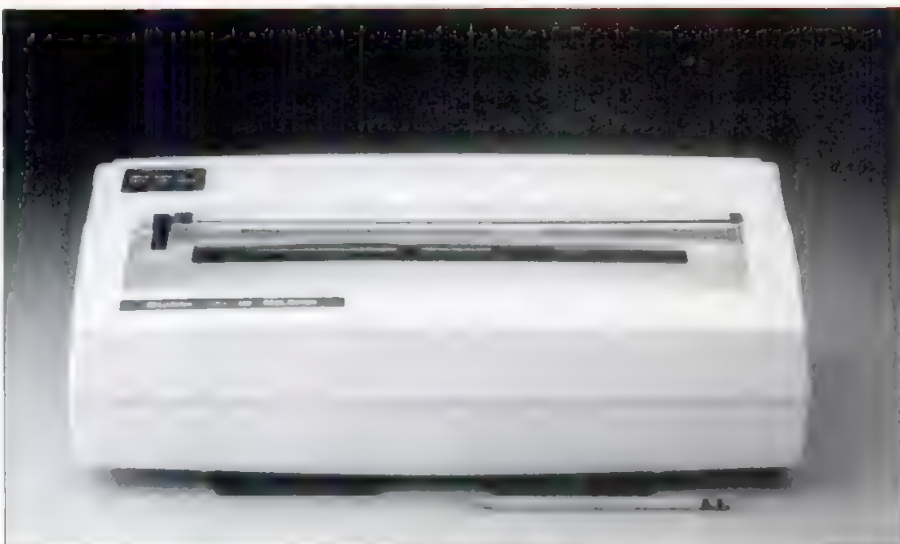
At the last possible moment in this project, Diablo sent us the P32 printer for review. According to the manual, the only difference between the P12 and the P32 is the width of the machines and the width of the print lines. The P12 is 16.3 inches

wide with an 8-inch print line. The P32 is 20.8 inches wide with a 13.2-inch print line. Everything else is supposed to be identical.

Our testing, however, revealed two additional differences—one in speed and one in quality. Where the P12 tested at 61.1 cps for draft quality printing, the P32 tested at a very much improved 88.5 cps. (Both printers tested at about 31 cps when using correspondence quality.)

The quality of the printout was also somewhat better with the P32. This is not

to say that I was satisfied with the so-called correspondence quality of the P32. At least I had no trouble adjusting the ribbon to eliminate smudges of ink on the paper, as the reviewer of the P12 did. It's not clear whether this means that the P32 has some honest advantages over the P12, or that Diablo has smoothed out some wrinkles in producing the machine, or simply that Diablo has uneven quality control. But the P32 is still nothing to get excited about; I'd take a pass on this one.
—M. David Stone



P12 and P32

Diablo Systems, Inc.
901 Page Ave.
P.O. Box 5030
Fremont, CA 94537
(415) 498-7000

List Price: P12, \$699; P32, \$1,095

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using the Power On Default feature(s).

using the emphasized feature(s).

using the double strike feature(s).

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Manufacturer	Model	Type	Price	Country	Dimensions (inches)	Line Spacing (inches)	CPS	Effective CPS	Quality
Star Micronics, Inc.	Radix-10PC	Impact	\$849	Japan	4.6x16.3x13.6	20.1	200	88.5	27.4
NEC Information Systems	P2 Pinwriter	Impact	\$875	Japan	4.9x16.1x13.1	17.6	180	82.2	20.1
Siemens Comm. Systems	PT-88	Ink jet	\$895	Germany	10.5x20.5x18.5	25.0	150	70.4	28.3
Texas Instruments, Inc.	855	Impact	\$935	USA	5.0x17.0x13.0	15.0	150	101.6	15.3
C. Itoh	1550EP	Impact	\$950	Japan	5.2x21.6x11.8	24.1	120	107.9	23.7
Diablo Systems, Inc.	P32	Impact	\$995	Italy	6.5x20.8x12.6	27.5	150	88.5	31.7
Facit Data Products	4512	Impact	\$995	Japan	6.0x25.0x13.0	37.0	140	107.9	16.8
Toshiba America	P1340	Impact	\$995	Japan	5.9x16.5x11.6	22.0	144	78.4	40.1
Mannesmann Tally	MT-180	Impact	\$1,098	Switzerland	6.1x19.1x9.6	22.0	160	127.8	26.5
Okidata Corp.	Microline 84 (Standard)	Impact	\$1,099	Japan	5.2x20.1x12.9	30.9	200	127.9	27.9
Okidata Corp.	Microline 84 (Plug 'n' Play)	Impact	\$1,099	Japan	5.2x20.1x12.9	30.9	200	98.7	21.3
Micro Peripherals Inc.	PrintMate 150A	Impact	\$1,150	USA	7.5x23.0x15.7	25.0	150	119.0	84.2
Genicom Corporation	3014	Impact	\$1,195	USA	5.0x24.7x15.6	34.0	160	115.1	26.9

Paper Feed: UT—Unidirectional tractor; BT—Bidirectional tractor; RSS—Roller, single sheet; RSF—Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper **Paper Source:** F—Front, R=Rear; B=Bottom **Printing Features:** H—Horizontal emphasis, V—Vertical emphasis, C—Correspondence quality (matrix), U=Underline, S=Sub/Superscript, R—Red ribbon **Formatting Features:** P—Proportional spacing, J=Justified lines; C=Centered lines, LH—Variable line heights, FL—Variable form length, HT=Horizontal tabs, VT=Vertical tabs **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available Otherwise, N/A=Not applicable **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language, DL=Download characters;

Quality Feature Used	Rated DPI	Horizontal Resolution DPI	Vertical Resolution DPI	Paper Feed	Resolution DPI	Width (inches)	Type Pitches	Printer Features	Formatting Features	Resolution Increment	Smallest Vertical Pitch
Emphasized, double strike	50.0	83.0	82.0	BT,RSS, RP(O)	R	9.5	5,8,5,10, 12,17	H,V,U,S	P,LH,FL, HT,VT	N/A	1/216
Letter quality	62.0	79.0	78.0	UT,BT (O),RSS, RSF(O), RP(O)	R	9.5	5,10,12,17	H,V,C, U,S	P,LH,FL	N/A	1/240
Double strike	N/A	<60.0	65.0	BT,RSS, RP(O)	R	9.5	5,9,10,17	H,U,S	P,LH,FL, HT	1/72	1/216
Quality, bold	62.0	78.0	77.0	UT(O), RSS, RP(O)	R	9.5	5,6,6,25, 7,5,8,35, 10,12,15	H,V,C, U,S	P,J,LH,FL, HT,VT	1/120	1/144
Bold, emphasized	63.5	83.0	82.0	RSS,PFR	R	15.0	5,8,5,10, 17	H,V,U,S	LH,FL,HT	N/A	1/216
Correspondence quality	N/A	69.0	70.0	RSS,PFR	R,F,B	15.0	5,8,3,10, 12,16,6	H,V,C, U,S	LH,FL,HT, VT	N/A	1/216
Bold, emphasized	65.0	75.0	74.0	UT,RSS	R,B	15.0	5,8,5,10, 17	H,V,U,S	P,LH,FL, HT	N/A	1/216
High quality	N/A	72.0	71.0	UT,RSS	R,F	10.0	5,8,3,10, 12,16,7	C,U,S	P,LH,FL, HT,VT	1/120	1/48
Correspondence quality	60.0	78.0	79.0	BT,RSS	R	15.0	5,8,5,10, 20	C,U,S	J,C,LH,FL, HT,VT	N/A	N/A
Correspondence quality	65.0	83.0	82.0	UT,RSS, RSF(O)	R,B	15.0	5,8,5,10, 12,17	H,V,C, U,S	LH,FL,HT, VT	N/A	1/144
Correspondence quality	65.0	81.0	86.0	UT,RSS, RSF(O)	R,B	15.0	5,8,5,10, 17	H,V,C, U,S	LH,FL,HT	N/A	1/144
Correspondence quality	64.0	80.0	79.0	UT	B	15.0	5,10,12,15	C,U	LH,FL,HT, VT	N/A	1/8
Near letter quality	65.0	81.0	80.0	BT,RSS, RSF(O)	R	15.0	5,6,6,5, 7,5,8,6,10, 12,13,1,15, 17,2	H,V,C, U,S	LH,FL,HT, VT	N/A	1/144

AF-Alternate fonts, AC-Alternate character sets; IBM PC Compatibility: L-Low-order characters, H-High-order characters, C-IBM PC Graphics Printer command sequences. Graphics Compatibility: D-PC DOS graphics command compatible (3.01 DOS 3.0 required), G-Incompatible graphics, V-Vendor supplied software for compatible graphics. Ribbon or Refill Type: S-Spool, C-Cartridge, CL-Cloth, CA-Carbon, I-Ink jet refill, T-Thermal paper. Front Panel Controls: O-On/Off line, F-Form feed, L-Line feed, FL-Combined form and line feed, E-Error message and correction, P-Power-on settings. # Mixable Colors: MP-Multiple passes produce combinations. Ribbon Colors: A-Process, B-Process or primary, (O)-Optional.

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			IBM PC Compatibility	Compatible	Other Printer Compatibility	Line Length	Ribbon Type or Refill		Front-Panel Controls
Star Micronics, Inc.	Radix-10PC	FL,DL, AC	L,H	D	—	16,384	C,CL	\$10.00	O,L,F,P
NEC Information Systems	P2 Pinwriter	DL,FL, AF	L,H	D	—	3,584	C,CL	\$12.00	O,L,F,E,P
Siemens Comm. Systems	PT-88	FL,AF	L,H,C	D	Epson	0	I	\$15.00	O,L,F,E
Texas Instruments, Inc.	855	DL,FL, AF,AC	L	D	Epson MX-80 Graftrax	256	C,CL	\$10.00	O,L,F,E,P
C. Itoh	1550EP	—	L,H,C	D	—	2,048	C,CL	N A	O,L,F
Diablo Systems, Inc.	P32	FL,DL	L,H,C	D	Epson	2,048	C,CL	N A	O,F,E,P
Facit Data Products	4512	FL	L	G,V	—	2,048	C,CL	\$10.00	O,L,F
Toshiba America	P1340	FL,AC	L	G	Qume Sprint 5	N A	C,CL	N A	O,L,F,E,P
Mannesmann Tally	MT-180	FL	L,C	—	Epson, Diablo	2,048	C,CL	N A	L,F
Okidata Corp.	Microline 84 (Standard)	DL,FL	L	G	—	2,048	S,CL	\$7.00	O,L,F,P
Okidata Corp.	Microline 84 (Plug 'n' Play)	—	L,H,C	D	—	2,048	S,CL	\$7.00	O,L,F,P
Micro Peripherals Inc.	PrintMate 150A	FL	L	—	—	2,048	C,CL	\$20.00	O,L,F,P
Genicom Corporation	3014	FL,DL, AF,AC	L	D	Epson	2,048	C,CL	\$23.50	O,L,F,E

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front, R=Rear, B=Bottom. **Printing Features:** H=Horizontal emphasis, V=Vertical emphasis, C=Correspondence quality (matrix), U=Underline, S=Sub-Superscript, R=Red ribbon. **Formatting Features:** P=Proportional spacing, J=Justified lines, C=Centered lines, LH=Variable line heights, FL=Variable form length, HT=Horizontal tabs, VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language, DL=Download characters, AF=Alternate fonts, AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters, H=High-order characters, C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required, G=Incompatible graphics, V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool, C=Cartridge, CL=Cloth, CA=Carbon, I=Ink jet refill, T=Thermal paper. **Front Panel Controls:** O=On/Off line, F=Form feed, L=Line feed, FL=Combined form and line feed, E=Error message and correction, P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process, B=Process or primary, (O)=Optional.

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Download any of **5 different IBM character sets**, including the Matrix, Graphics 1 and Graphics 2 printer sets, the

Screen set and the APL set. Use IBM block and line graphics characters, IBM screen characters, Greek and APL symbols on any Epson printer. Printer Boss™ is ideal for IBM graphics software and for **screen dumps**.

Or **custom-design your own character font** using our new font design feature, and build a library of your own fonts for future use.

Printer Boss™ also allows **full menu-based operation** of all control functions of all of the Epson printers. Select and deselect pica, elite, compressed, italic, enlarged, emphasized, double-strike, underline, superscript and subscript for scores of different type faces. Switch the LQ-1500 between draft and letter quality.

Set line spacing, right and left margins and skip-over-perforation. Load USA, France, Germany, England, Denmark, Sweden, Italy, Spain and Japan language sets. **Control** unidirectional, half-speed and proportionally-spaced printing. **Store** and retrieve 10 complete menu settings with a few keystrokes. **Emulate** the IBM-label printer for the IBM-PC.

Print **samples** from the menu, or use program modules provided for printing ASCII tables and spreadsheet and text samples. **Create ASCII files of data,**

corresponding to the stored menu settings, which can be accessed by or included in your own programs to set up the printer as you wish.

Printer Boss provides all of the above features on **one easy-to-use menu**, and it's compatible and extremely useful with such word processing and spreadsheet programs as **Wordstar**, **Lotus 1-2-3**, **Visicalc** and many, many others. The package is streamlined, professional and intended for serious work by seasoned PC users, but is **easily operable by the neophyte**. As a primary objective the development team designed the menu and its operation to minimize mental effort and fatigue in printer set-up and operation, which is particularly important for the newcomer to computers.

Printer Boss™ runs on the IBM-PC, IBM-PCjr, IBM-XT or any compatibles; PC-DOS 1.1, 2.0, 2.1 or equivalent; double-sided disk drive; 128K RAM; Epson MX, FX, RX, JX or LQ-1500 printers or compatibles.

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ComRiter 420

The Comrex ComRiter 420 is a dot matrix printer for those who want to live life in the fast lane. The manufacturer claims a top cruising speed of 417 cps, which translated to a real 230 cps in our tests. You could file the ComRiter 420 under *S* for Speedy, but you could also file it under *S* for Sloppy, because the squiggly

character font makes the reader feel hung-over no matter what print enhancements you use. Close inspection of the type shows that the dots making up the vertical parts of the letters do not line up—apparently on purpose to distinguish the type. It does: it makes it look ugly.

The printer is somewhat stylish for its size, but despite its newness, it has just the standard front-panel switches and lamps. It has a standard 15-inch carriage and a movable tractor-feed assembly that posed

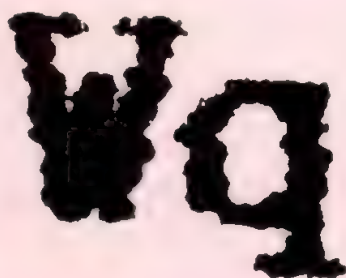
no problems in loading or feeding paper even at top speed. That was impressive since I expected jam after jam at these speeds. The extra-long ribbon ink cartridge snapped into place simply, but the single ribbon groove guide was slightly bent, causing the bottom half of the characters to drop out. I rebent the guide as I thought it should be set, and everything worked fine. Nonetheless, I didn't like having to bend a piece of new equipment that way.

Characters can be set to wide, compressed/wide, pica, elite, or compressed pitches, or spaced proportionally. Several fonts and seven foreign languages are available through escape codes. And the usual array of print enhancements can be invoked: horizontal and vertical emphasis, underlining, and subscripts and superscripts. Correspondence-quality mode came out dark enough and at the fantastic pace of 80 cps. But, again, the characters look awkwardly formed. You wouldn't want to buy this printer for correspondence—at least not if you hope to impress those with whom you correspond.

The documentation was still in preproduction format when I tested this model; so it can hardly be judged fairly. There were illustrations of the printer, but I could make out Seikosha labels on the machines! And there were some minor mistakes, which the technical-support person I talked with admitted. It seems we had been sent a preproduction model in a hurry. Considering that, the manual sufficed well enough, and I experienced no problems invoking most features using the documented escape sequences.

The ComRiter 420 has graphics capabilities compatible with PC-DOS, which is a big plus because the speed of its graphics printing is excellent. It also has a huge 18K buffer memory.

All in all, while the speed is great, I wouldn't want to read the ComRiter 420's output for more than a page or two at a time. It's just too dizzying, and the price you have to pay for that speed just doesn't seem worthwhile. —Phil Wiswell



ComRiter 420
Comrex International, Inc.
3701 Skypark Dr.
Torrance, CA 90505
(213) 373-0280
List Price: \$1,995

CIRCLE 707 ON READER SERVICE CARD

using the Power On Default feature(s).
using the bold feature(s).
using the correspondence quality feature(s).
using the correspondence and bold feature(s).

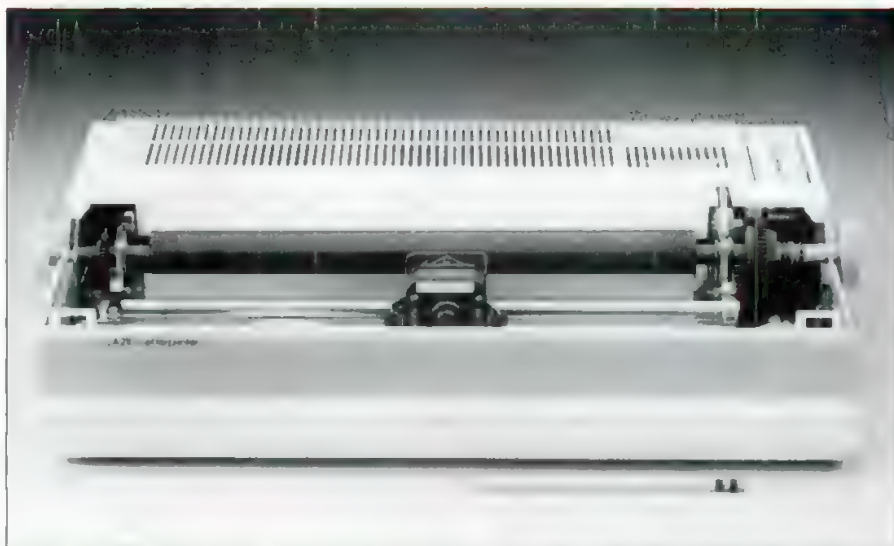
DEC LA 210

I know that DEC doesn't stand for Don't Ever Call, but after 2 hours of fruitless and frustrating phone calls to the company, I began to wonder. The problem was that I received a prerelease version of the DEC LA 210 configured for a DEC, rather than an IBM PC, serial port. My initial calls to DEC for advice on adjusting the unit were all met with a cool "it's someone else's problem." Fortunately, I did receive competent support once I got through to the proper person. In all fairness I should also note that the normal DEC service channels were not available to me since I was testing a prerelease model.

So much for the good news. I've seen worse printers, but not many. When I unpacked the printer and began to set it up, the first thing I noticed was its cheap, flimsy feel. The switches for adjusting the paper sensor and platen felt as if they would snap off in my hand. And if the ribbon adjustment lever is set a millimeter too far one way or the other, the print will either smudge or not be dark enough. This means taking advantage of the LA 210's near-letter-quality print requires patience and reams of paper to practice with.

A unidirectional tractor is supposed to be standard equipment with the LA 210, but it wasn't yet available at the time of testing. The standard typewriter roller I had to use provided insufficient pressure for fanfold paper, which wandered all over the place. The platen itself was also a problem. The printhead rubbed against the backing of the platen, and I had to dismantle the platen and adjust the backing before it would print properly.

You can easily select either draft or near-letter-quality print with switches located at the top of the unit. However, I couldn't use escape codes to alternate between print modes. The LA 210 can emulate both an IBM and an Epson MX-80 printer (with or without Grafrax). Our testing was done using the IBM mode.



LA 210

Digital Equipment Corp.
129 Parker St.
Maynard, MA 01754
(800) DIG-ITAL
List Price: \$1,595

CIRCLE 691 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Letter quality re-do bold feature(s).
using the re-do bold draft feature(s).

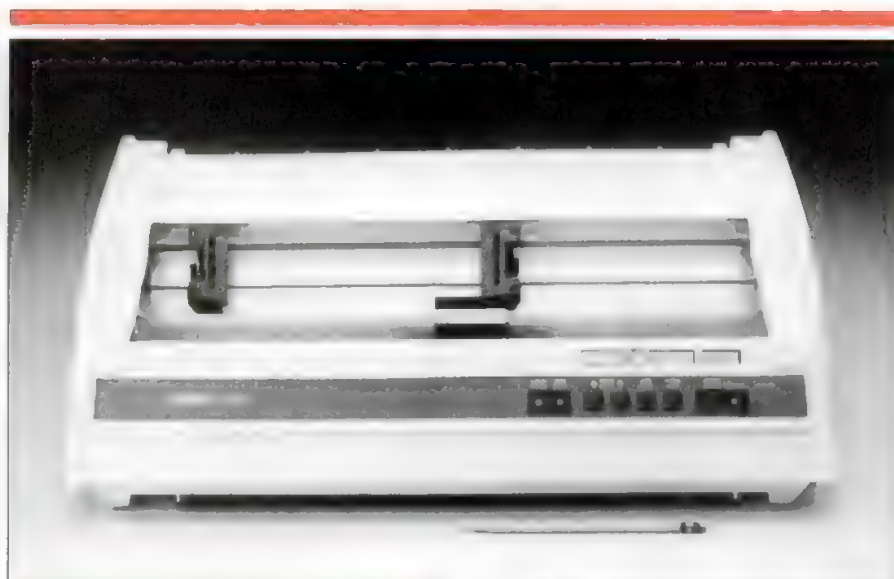
Most escape code features (boldface, compressed print, double-wide print, super- and subscripts) worked fine. I was unable to turn off the underline mode, however.

The LA 210 produced actual speeds of 138 cps in unenhanced draft mode and 77.3 using boldface in draft mode. I couldn't find any way to access correspondence mode; when I tried to test the letter quality feature, I kept getting a device timeout error from DOS, even though all

the cables were securely connected.

The manufacturer's speed ratings are 240 cps for draft mode, 80 for correspondence mode, and 40 for letter quality.

One of the few strong points of the LA 210 is its documentation. All four of the manuals provided with it were quite clear. Of course, I'd rather see a high-quality printer with an inadequate manual than the reverse. And until DEC fixes the problems in this printer, I'd stay away from the LA 210.—Gary Markman



910
 Printek
 1517 Townline Rd.
 Benton Harbor, MI 49022
 (616) 925-3200
List Price: \$1,595

CIRCLE 767 ON READER SERVICE CARD

using the Power On Default feature(s).
 using the correspondence quality font 1 featur

Printek 910

The only discernible differences between the Printek 910 and the Printek 920 dot matrix printers are their prices and print speeds. The 910 is rated at 200 cps and tested at 143 cps. Its price is \$1,595, a savings of \$800 over the 920. You lose a little less than 60 characters per second compared to the 920's tested 200 cps.

That's less than \$10 a character, which is not a bad trade-off.

The Printek 910 insisted on generating a device-timeout error on the PC every so often. In addition to the timeout, the printer occasionally overprinted a few characters when the pitch was changed in the middle of a line. The Printek technical staff blamed a bad chip and sent a replacement, which did not have the overprint problem, but still allowed a device timeout in the correspondence quality speed test.

Except for speed, both printers have identical features. The 910 can print in correspondence quality, use a variety of pitches, underline text, and print subscripts and superscripts. It also has horizontal and vertical tabs and a double-width enhancement. The printer can handle any of eight different form lengths, from 1 inch to 14 inches. Although the Printek

Unfortunately, the Printek 910, like the 920, lacks true IBM PC compatibility.

910 did not pass PC's graphics test, a spokesman said that the company will support anyone with problems. The printer's graphics mode permits the mixing of text and graphics.

The Printek 910 uses the same housing as the 920. Because of its large size (17 by 23 inches), it needs more room than many other printers. And, at 35 pounds, it isn't light enough to move around easily. But the control panel is more than adequate, and the DIP switches are right at hand.

The well-organized and clearly written manual uses photographs with overlaid pointers throughout the chapters on installation and operation procedures. The information in two of the six appendixes, "Summary of Switches and Buttons" and "Ribbon and Paper Specifications," should have been kept within the manual proper for clarity.

The staff at Printek seem to be interested in helping their customers and supporting their printers. Unfortunately, I cannot recommend the Printek 910 because, like the 920, it lacks true IBM PC compatibility and doesn't have enough features to justify its high price.—**Vincent Puglia**

Printek 930

Some printers are prima donnas—you exist for their amusement, and they in turn stingily offer you a few features. Fortunately, the Printek 930 is like the girl next door. It may not be the printer of your dreams, but it is friendly; its features are easily accessible; and it forgives your transgressions.

The Printek 930 is a basic dot matrix printer that offers a reasonable amount of features for its \$1,995 price tag. It includes a variety of pitches, proportional spacing, half-line feeds (in place of subscripts and superscripts), and a fairly good correspondence quality typeface.

Its best feature, however, is its ease of use. The printer's 25 selectable DIP switches, for example, are located under the cover, just above the control panel. Anyone who has ever dismantled a printer to reset a baud rate will appreciate this accessibility. A chart explaining the switches is on the cover. The control panel also contributes to the printer's convenience. Among its nine lights and buttons is one that allows you to switch between draft and correspondence print.

What the Printek 930 lacks in standard features, it makes up for in options. If you need to print a large number of single-sheet forms, you can use the cut-sheet feeder. If the fonts are not to your liking, you can either obtain a new set or download one of your own into any of the three designated areas. You can even expand the 768-character buffer to 14K.

Other standard features that you can control via software are forward and backward printing, form and line-feed control, setting the horizontal motion index (HMI) in multiples of 1/120 of an inch, and setting the vertical motion index (VMI) in multiples of 1/48 of an inch. In addition to the normal pitches (10, 12, 13.3, 16.7 cpi), you can also set the Printek 930 to print double-width characters. The seven foreign-language character sets include 25

special characters. And you can enable or disable the wraparound feature, which performs a line feed and carriage return. The user who purchases the cut-sheet feeder has seven commands to load or eject the paper.

Although its graphics are not directly compatible with the PC's, the Printek 930 counters by enabling you to repeat previous graphic lines and to mix graphics and text on the same line. You can set the print density to 72 or 144 dots per inch. Accord-

ing to the manufacturer, the graphics mode print speed is 4608 dots per second.

The user's manual is clearly written and well illustrated with photographs. It contains several helpful appendixes, including one on computer interfacing examples (the IBM PC and the Apple II).

The Printek 930 is not the best printer on the market, but at a reasonable \$1,995, it may be worth more than a casual glance. —Vincent Puglia



930
Printek
1517 Townline Rd.
Benton Harbor, MI 49022
(800) DOT-INFO, (616) 925-3200
List Price: \$1,995

CIRCLE 748 ON READER SERVICE CARD

using the Power On Default feature(s).
using the executive quality feature(s).

Qantex 7035

Like the infamous Jekyll and Hyde, the Qantex 7035 dot matrix printer can mysteriously change character, alternating between flawless and flawed performance. At the beginning of its review period (which lasted more than four times as long as normal because of the machine's erratic behavior), it exhibited

virtually every bug found in its older sibling, the Qantex 7065. Then, the bugs mysteriously disappeared and it began performing as advertised—almost.

Besides price, the only difference between the two Qantex models is print speed. The 7035 is rated at 180 cps by the manufacturer. In *PC*'s tests, this decreased to slightly more than 123 cps.

The 7035's standard features include many not found on other comparably priced printers. Among them are Anadex

and Epson emulation modes (Diablo emulation is optional), four print speeds (two of which offer correspondence quality print), and the capacity to print bar codes. The printer also provides proportional spacing, underlining, boldface, emphasized and italic print, and vertical and horizontal tabs.

The graphics capability should have been the star in the printer's cast of features. However, it failed its audition. During the graphics portion of the testing, the printer refused to dump the test graph in any of its modes. This behavior was inexplicable, since the 7035 has exactly the same graphics features as the 7065, which passed the test easily.

The manual provided with the printer was labeled "preliminary." Although it appeared to provide enough information, it consisted of one long table after another with few explanations in between. The illustrations were as erratic as the printer itself. Although they were well drawn, the components in most of the illustrations were labeled only with numbers. Identifying the illustrated components usually required flipping through the text for references to the drawings—a slight inconvenience.

The control panel of the 7035 has enough handy buttons to make almost anyone happy. The DIP switches aren't completely hidden, but their access is hampered by the tractor feed.

Because of its unpredictable, gremlin-like bugs, I can not recommend the Qantex 7035. This is a shame, for I truly appreciated its many features.

—Vincent Puglia

Qantex 7065

The people at North Atlantic Qantex need an exterminator. Their Model 7065 dot matrix printer offers multitudes of impressive features, but an infestation of bugs robs it of much of its usefulness.

The first thing you realize about the



Qantex 7035
North Atlantic Qantex
60 Plant Avenue
Hauppauge, NY 11788
(516) 582-6060
List Price: \$1,695

CIRCLE 722 ON READER SERVICE CARD

using the Power On Default feature(s).
using the wp, two pass letter quality feature

Model 7065 is its compatibility. It emulates both the Epson RX-80 and MX-80 (with Grafrax), the Anadex 9620, and—optionally—the Diablo 630. The emulation modes are switch or control-code selectable, and they all work, albeit with a few bugs.

More than anything else, it's the bugs that bring this printer down. The first one must have spun its web somewhere near the tractor feed, because the paper insists on jumping out of its pin-held sprockets and wreaking havoc. I suspect the problem resides in the tractor clamps. The paper is supposed to be held in position by the clamps, sprockets, and the optional pinch-roller, but the complications caused by the options seem to cause undue stress on the holes—producing crumpled paper instead of neat printout.

The second bug makes its nest in the default print mode. Whenever I attempted to switch from 10 cpi to any other horizontal pitch, the printhead began printing in the new setting a few columns to the left of where it should have been, causing the type to overprint. This effect might be useful for creating op art, but it does little for standard text.

The same bug refused to carry many of the print enhancements beyond the line feed. The people at Qantex told me that it was not a bug and that I should check the autowrap DIP switch, but the documentation does not state that control codes are thrown out after a line feed, and the autowrap was on. In addition, the Esc-C sequence, which is supposed to reset the printer to the initial state, does much more than that—it shuts down the printer completely.

Other bugs hide in the emulation modes. One forced me to repower the printer because the paper had jammed. When I sent the proper control sequence to access the Epson mode, the printhead went beyond the DIP-switched 8-inch margin, froze at the right, and began screaming as though it had been hit with a full can of Raid. (Operating the printer causes a considerable amount of noise, but

powering it up is far worse.)

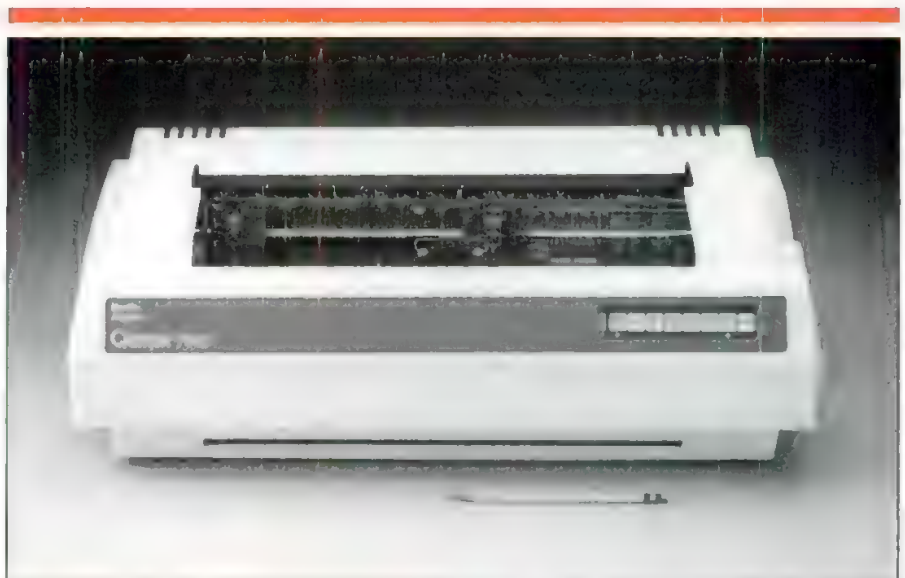
The Model 7065 does have its fine points, such as emulating a number of other respected printers. It can also switch to any of four printer speeds: two draft speeds and two word-processing speeds—one letter quality and the other close to it. You can even add optional fonts and print bar codes. But, on the whole, the Qantex 7065 is an impressive machine in desperate need of improved pest control.

—Vincent Puglia

NEC P3-3

The NEC P3-3 correspondence quality dot matrix printer is loaded with the marks of high style. From its design to its documentation to its performance, it's pure class all the way.

The unit comes equipped with an IBM plug-in adapter that's so easy to install I'd let my kid do it. Its eight type styles are



Qantex 7065

North Atlantic Qantex
60 Plant Ave.
Hauppauge, NY 11788
(516) 582-6060
List Price: \$1,995

CIRCLE 768 ON READER SERVICE CARD

using the Power On Default feature(s).

using the wp two pass letter quality feature(s)

using the Epson mode feature(s).

using the double strike feature(s).

both switch and software selectable, and an LED font indicator displays the present font regardless of whether the font was selected by hardware or software.

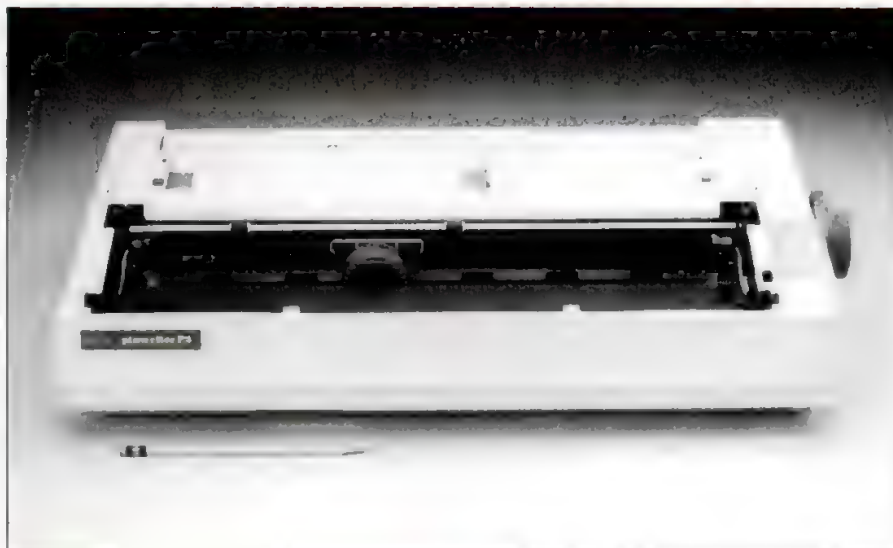
The clear and concise manual lists the escape codes in easy-to-use tabular form. The escape sequences go beyond what they were advertised to do by also working in combination. My version of a printer's rite of passage is to have it interpret a 2-foot-long sequence of codes containing instructions to print condensed, double-

strike, and double-wide type, with continuous underlining. Most printers choke. The P3-3 winked and did the job.

The manufacturer's rated speed for the NEC P3-3 is 180 cps in draft mode, 36 cps at 12 cpi in correspondence quality, and 30 cps at 10 cpi in correspondence quality. The print quality in the correspondence quality modes was excellent. *PC*'s benchmark speed tests produced 82.2 cps in draft and 20.3 cps in the 12 cpi correspondence quality mode.

Other impressive features of the P3-3 include eight foreign language character sets, downloadable character sets, and two proportional character fonts, a cartridge-based ribbon with a life of 3.3 million characters, a standard typewriter-style pressure roller, and an optional sheet feeder and bidirectional tractor. I tested the P3-3 using continuous-form paper in the friction mode and found no problems with the paper feed.

If you want a classy printer you can have up and running in an hour flat, the P3-3 is for you. —Gary Markman



P3-3

NEC Information Systems, Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000

List Price: \$1,150

CIRCLE 749 ON READER SERVICE CARD

using the Power On Default feature(s).
using the double strike feature(s).

Toshiba P1351

The Toshiba P1351 could change the image of dot matrix printers. A look at its correspondence quality output immediately elicits the question, "Where are the dots?" They are still there, just so tiny that they don't look like dots anymore. The characters appear fully formed, and even if a closer examination reveals that they're not quite as sleek as output from a typewriter or a good daisywheel printer, no one need feel ashamed to send out letters produced by this printer.

The P1351's \$1,895 price will keep it out of most homes, but it's a natural for the office. It easily fulfills a key business requirement—the high-speed generation of computer correspondence that doesn't look like it came out of a computer. In addition, its wide carriage, variety of fonts, and optional tractor and single-sheet feeders make it a good candidate to replace the NEC 3550 Spinwriter as the standard correspondence quality printer for the IBM PC.

The printer handles single sheets without attachments, but the optional tractor-feed attachment proved difficult to install. I had to put the manual aside and go by instinct. There are a half dozen ways to thread paper through the tractor feed, only one of which works. Plus, the paper supply tends to become dislodged if not placed directly behind the tractor feed,

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ing the program under test; and evaluation, source, program and history windows.

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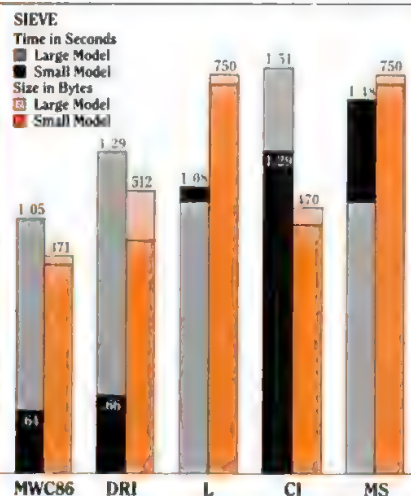
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TEAR AND COMPARE

which makes it necessary to remove the paper entirely and start over.

The somewhat technical manual jumps directly from the mechanical setup of the printer to a complete explanation of the control sequences used to control exotic print functions. The good documentation on software control of the printer's features offers examples in BASIC, including complete program listings.

The selection of fonts is impressive. Three separate fonts are normally available: a draft quality default as well as a Prestige Elite and a somewhat bolder Courier, both correspondence quality. You sacrifice only about 30 percent of the print speed for correspondence quality, but the draft quality output is also quite attractive—somewhat boxy and stark, but clean and plainly readable. You use software control sequences to select the font. You can change the power-on default to either of the two correspondence quality fonts using DIP switches conveniently located in front of the machine, right under the cover. The P1351 lacks double-strike or emphasized modes, but switching from the Prestige Elite to the Courier font produces nearly the same effect.

Also, the printer can store two additional character sets. You download these into the printer and select them using control sequences the same way you select the three fonts already in the machine.

I had the opportunity to try out three additional font programs. Toshiba's own \$49.95 diskette includes a gothic, a bold-face italic, and an original. Programs from Greentree Software and Fonts America range from \$35 to \$50. Greentree's program provides foreign letters, math symbols, and line graphics (in fact, the entire array of the extended IBM screen graphics characters) in the printer's standard correspondence-quality typefaces. Fonts America offers three different fonts: a gothic and two italics. I normally dislike script and italic styles, but I must admit that these are stunning.

Unfortunately, despite this versatility, you can't download a single font that



Wq

P1351

Toshiba America
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680
(714) 730-5000

List Price: \$1,895

CIRCLE 791 ON READER SERVICE CARD

using the Power On Default feature(s).

using the High Quality Elite Font feature(s).

using the High Quality Courier Font feature(s)

duplicates all of the IBM screen graphics characters. The fonts are defined for only 126 characters. Therefore, a Print-Screen utility for the Toshiba printer that handled the complete IBM screen character set would have to switch around from font to font, a real annoyance for most users. Toshiba would do well to put together some software to fix this problem—it would make delectable icing on top of an already outstanding cake.

—Charles Petzold

Datasouth DS 180

Datasouth's DS 180 could be described as a plain-vanilla printer at a hot-fudge sundae price. It produces draft quality text at a manufacturer's rated speed of 180 cps. But it lacks a correspondence quality mode, slick fonts, and a friction feed (adjustable tractors are standard). But, if you need quick turnaround times and aren't

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to live with.**

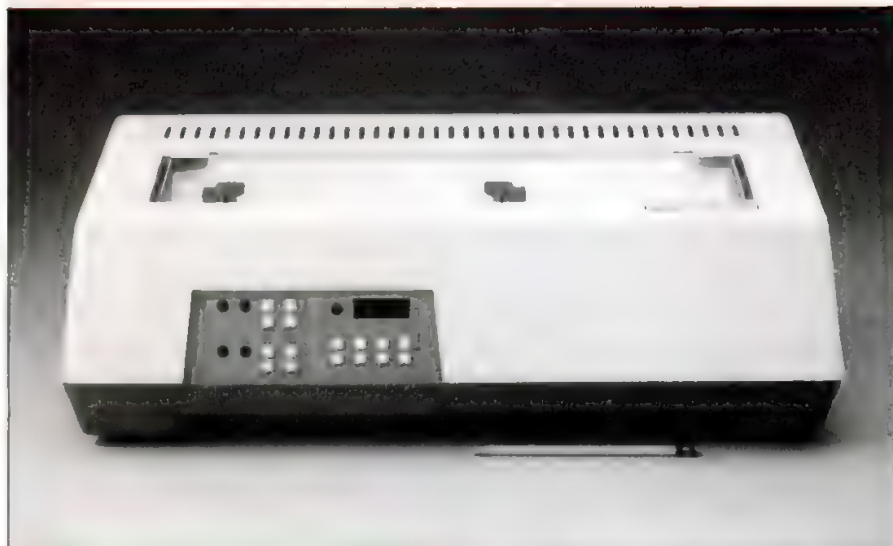
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integration without compromise



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DS 180

Datasouth
4216 Stuart Andrew Blvd.
Charlotte, NC 28210
(704) 523-8500
List Price: \$1,595

CIRCLE 771 ON READER SERVICE CARD

using the Power On Default feature(s).

interested in printing, the DS 180 operates like a real workhorse. The manufacturer probably didn't design it to withstand terrorist bomb attacks, but it looks like it might.

PC's benchmark test produced an effective speed of 127.8 cps. When using the benchmark software, which depends on built-in printer features, the printer did not support any special effects. However, the manufacturer claims that it will produce all the standard effects *WordStar*

is capable of when *WordStar* is configured for a teletype printer.

This is not the printer to use for serious word processing. But it backspaces well enough to produce special effects that way, if necessary. In a pinch, it can generate print at least close to correspondence quality using continuous double strike. If you have mountains of words to move every day, the DS 180 might be just the combination printer-bulldozer that could help you do it.—Gary Markman

Datasouth DS 220

The Datasouth DS 220 is a medium-high-speed, medium-heavy-duty dot matrix printer. Made in America, with a definitely American price, it appears to be an interesting printer. But as you get to know the DS 220, you begin to lose interest rather quickly.

Some of the DS 220's design features differ from those of similar printers. The one-piece case with a rectangular opening in the top gives the machine a great deal of rigidity. But it's a liability when you want to adjust the pressure on the printhead, for example.

The manufacturer intends you to use tractor-feed forms only. (You can make up to six copies.) Datasouth has done away with the roller platen altogether, and you pull the forms over a fixed metal platen. Although not unique to the Datasouth DS 220, the scheme seems to work well. A little more unusual is the way that the tractor mechanism uses what Datasouth calls "pinch rollers" to pull through roll

The one-piece case with an opening in the top is a liability when you want to adjust the pressure on the printhead.

forms. You feed the paper from either the bottom or the front of the printer.

The operation of DS 220 correspondence quality mode is also unusual. The printhead makes the first pass over each

line going forward; it then prints the second pass backward over the same letters. This technique requires extremely accurate tracking with virtually zero backlash. By incorporating this design, Datasouth would seem to be expressing confidence in the long-term stability of the printer.

The escape codes Datasouth uses to access its special features and fonts are more cumbersome than those of many comparable printers. They are also poorly documented. After trying unsuccessfully to figure out from the documentation how to enter the codes, I had to call the company for help.

The print quality in all modes was not up to what I would expect for the price. Also, Datasouth claims compatibility with Epson graphics, but our test did not prove it. Although Datasouth is to be commended for trying to buck the flood of competitors from overseas, I'm afraid the DS 220 doesn't speak convincingly for American ingenuity. — **Jim Forney**

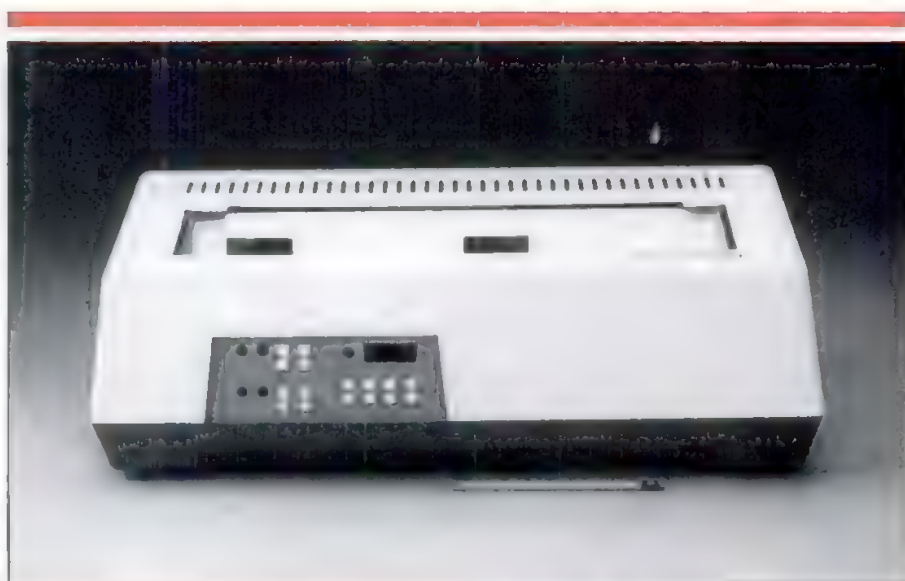
Fujitsu DPL24

The Fujitsu DPL24 heralds the approaching era of dot matrix printers that produce print that is truly indistinguishable from that of fully formed character machines. Aside from that, it has a typical array of strengths and weaknesses.

The DPL24 powered up without complaint, limbered up its 24-pin head with a few test patterns and character sets, then ripped off a series of pages of very near-letter-quality print, propelling the DPL24 toward the top of its class.

This \$1,995 printer effortlessly churns out 128 cps in its quite legible draft mode, and 111 cps in its correspondence mode, which is a match for other dot matrix printers' very best output. Finally, it also produces 72 cps in its letter quality Courier 10 font, which could give some daisy-wheel printers a run for their money.

Two thousand dollars buys a lot of bells and whistles, including a 15-inch carriage, built-in bidirectional tractor, automatic



DS 220

Datasouth

4216 Stuart Andrew Blvd.

P.O. Box 240947

Charlotte, NC 28224

(704) 523-8500

List Price: \$1,995

CIRCLE 681 ON READER SERVICE CARD

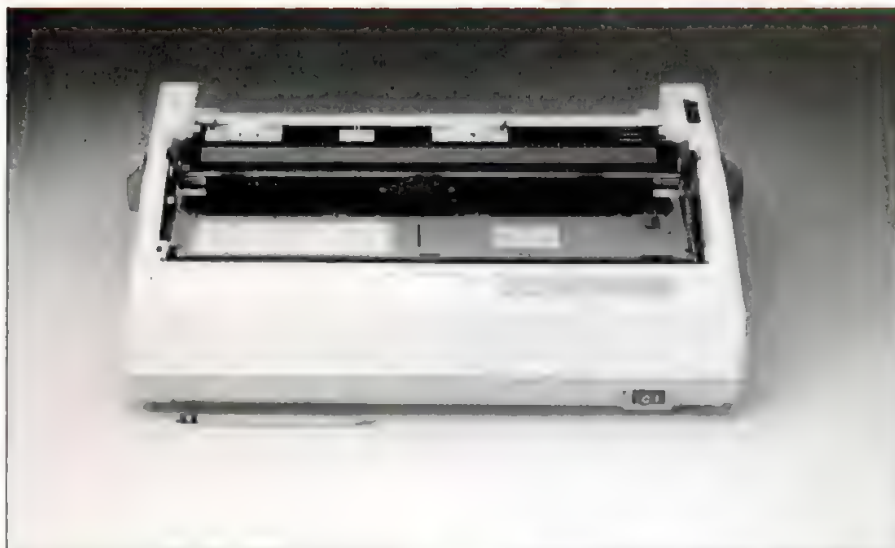
using the Power On Default feature(s).

single-sheet loading in conjunction with a paper bail that retracts to avoid jams, dot positioning to 1/360-inch horizontally and 1/180-inch vertically, and six on-line character sets (more are available through font cartridges, graphics, and parallel and serial interfaces). Single- and double-bin sheet feeders from third parties are \$1,400 and \$1,950 options, and Fujitsu is now preparing a less-expensive single-bin feeder.

The only important things you don't get

for your money are IBM command sequence and graphics compatibility, a decent manual, and an easy-to-use front panel. Fujitsu America says a DPL24G version specifically for the IBM PC, with two graphic character sets, should be released this fall. A plug-in ROM cartridge will do the same thing for existing DPL24s.

If you do buy this printer, be sure to get it from a dealer who has experience with Fujitsu products. Without good technical

**Fujitsu DPL24**

Fujitsu America, Inc.
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777

List Price: \$1,995

CIRCLE 732 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Letter Quality (Courier 10)

Bold feature(s).

support, your \$2,000 buys a 44-pound paperweight. You won't be able to make head nor tail of the instructions, which consist of a 62-page, unbound document and a 110-page, 8½- by 11-inch photocopied interface guide. (The Fujitsu name is not mentioned in the manual because the printer is also marketed under other names. The machine itself is almost free of Fujitsu markings, too.) Luckily, it's unlikely that this printer will appeal to novices, who need good manuals. An

entry-level user owning the DPL24 is akin to a student pilot flying a 747.

DIP switches hidden behind a panel on the front cover enable you to power up or reset the DPL24 to any of the six supplied fonts or optional \$92 ROM cartridge fonts, and to choose character widths, page lengths, language sets, and so on. You can also set all these by sending escape codes over from the PC. For the font settings, a better arrangement would be a more rugged selector button and LED

indicator mounted on the top panel, so nontechnical users could easily shift between draft and letter quality modes. The LED could double as an error-code indicator instead of the current arrangement, whereby combinations of the two check lights and the on-line light mean different problems.

Built-in character fonts include the letter quality Courier 10 and a Prestige Elite

The DPL24 heralds the era of dot matrix printers that produce print indistinguishable from that of fully formed character machines.

as well as boldface, correspondence, draft, and letter quality compressed faces. The draft quality appears squiggly but well-formed, with no individual dots evident. The letter quality mode mimics fully formed typewriter characters with thick and thin strokes; straight-line characters such as *i*, *7*, and *T* are especially good, while rounded characters such as *h*, *e*, and *o* are a bit ragged. Proportional spacing is available and can be used without special support from your word processing program.

The 22- by 15- by 6½-inch DPL24 appears solidly built, and its output is outstanding. I am concerned about support from the importer, though. Fujitsu is not as well-established here as other Japanese companies are, and the pidgin-English manual and unnecessarily complex operator panel lead me to doubt the overall support that the company provides.

If you need high speed and perfect letter quality, spend \$1,000 on a fast dot matrix printer and \$1,000 more on a nice, easygoing daisywheel or thimble printer. If, on the other hand, you can live with 95 or 98 percent of letter quality at 72 cps, check out the DPL24. It's that good.

—William K. Howard

Epson LQ-1500

One source of frustration for printer reviewers is equipment that has many good points, but just enough drawbacks to fall short of a rave review. The Epson LQ-1500 fits into this category.

Make no mistake, this printer has a lot going for it. Its draft quality output, which I measured at just over 93 cps, is quite readable. Moreover, its correspondence quality output, at just over 49 cps, is excellent. It may not be the best quality I've seen in a dot matrix printer, but it is good enough so that you have to look closely in order to see the telltale dots. The PC-compatible graphics also deserve special mention.

Another advantage of the LQ-1500 is its manual. Nicely typeset and filled with useful illustrations, it told me pretty much what I wanted to know and made it easy to find information in a hurry, particularly when setting up the printer. The illustrations and directions enabled me to set it up while talking on the phone, even though I had to attach a separately packaged interface module.

I also appreciated the convenient reference card listing all of the printer commands. The commands are explained in greater detail in another part of the manual, but if you're familiar with printers, the reference card may be all that you'll need.

Given everything this printer has going for it, it is unfortunate that it falls apart in other areas—but fall apart it does.

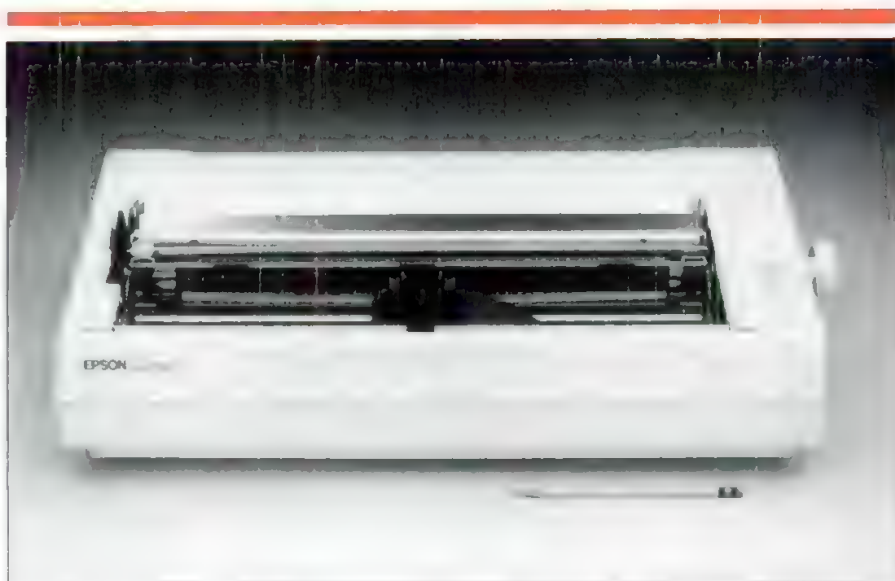
The LQ-1500 has a plastic paper guide that fits on the rear top of the printer. You have to thread the paper under the guide,

through the roller, then through something that Epson calls a dust cover, and then up over the top of the guide. The "dust cover" serves to deaden the sound somewhat, but it complicates the paper-threading process.

Even more troublesome, the paper guide kept falling apart, and, try as I might, I could not make it stay in place. At one point, someone rested a manual on the paper guide while we talked about the problems I was having with the guide.

When he picked up the manual, the paper guide fell to the floor, and everyone in the room laughed. This sort of thing is a big joke when you're testing a printer, but it ceases to be funny when you have to live with it.

This problem might well disappear with the optional tractor feed, but I'd want to check that out before spending money on this printer. I certainly cannot recommend the Epson LQ-1500 with the standard paper guide.—M. David Stone



LQ-1500

Epson America, Inc.
3415 Kashina St.
Torrance, CA 90505
(213) 539-9140
List Price: \$1,395

CIRCLE 730 ON READER SERVICE CARD

using the Power On Default feature(s).



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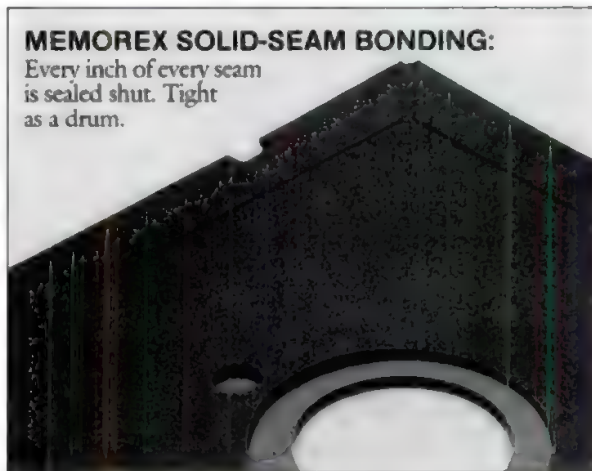
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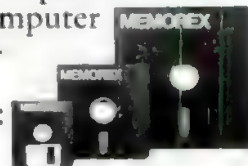
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CIRCLE 345 ON READER SERVICE CARD

CIE CI-3500

This is the printer I have been waiting for! The CIE CI-3500 is almost entirely IBM compatible, has a number of additional useful features, and is incredibly fast. *PC*'s tests clocked it at 247 cps using its default "data processing" print quality mode. At that rate, I almost expected it to get a speeding ticket.

CIE is an American firm connected with Japan's C. Itoh Electronics, which is well-known for its printers. Although still being beta tested and therefore not quite in its final form, the CI-3500 has all the makings of an excellent machine. It's attractive and well built, and its use of replaceable firmware cartridges makes it open to further expansion and enhancements.

The mechanical precision necessary for high-speed printing makes loading ribbon and paper somewhat more difficult in the

CI-3500 than in slower machines. CIE provides a pair of plastic glove that you'll need to keep your hands clean while you wind the ribbon around four guide posts. Running the paper through the tractor feed is also tricky because the tractors are dou-

The CIE-3500 is almost entirely IBM compatible, has many added useful features, and is truly fast.



CI-3500 (Model 20)
CIE Terminals
2505 McCabe Way
Irvine, CA 92714-6297
(714) 660-1421
List Price: \$1,995

CIRCLE 719 ON READER SERVICE CARD

Wq

using the Power On Default feature(s).

using the Bold Print feature(s).

using the Letter Quality feature(s).

ble sided and control the paper coming in and going out of the machine.

A magnetic switch prevents the machine from being operated with the cover up—a good safety precaution for a machine this fast. I advise you not to mess about with this switch; it's difficult to override, and you could easily damage it by trying to do so.

Once the CI-3500 gets going, it's a real marvel. It has all the IBM screen graphics characters, duplicates all the control sequences, and can print a screen from the color graphics monitor with no extra software except the normal PC-DOS GRAPHICS program. In addition, it has a letter quality font which, though not the best I've seen from a dot matrix printer, will be fine for most applications. This font prints at a slower speed than the default quality font, but I could not run the speed test program for it, owing to a ROM problem that CIE claims has already been fixed in the version that will go on the market.

The CI-3500 even improves many of the features that are standard on IBM, Epson, and compatible printers. These machines can produce an enlarged type,

Dear Smith-Corona,

Imagine sending an important letter printed on a dot matrix printer.

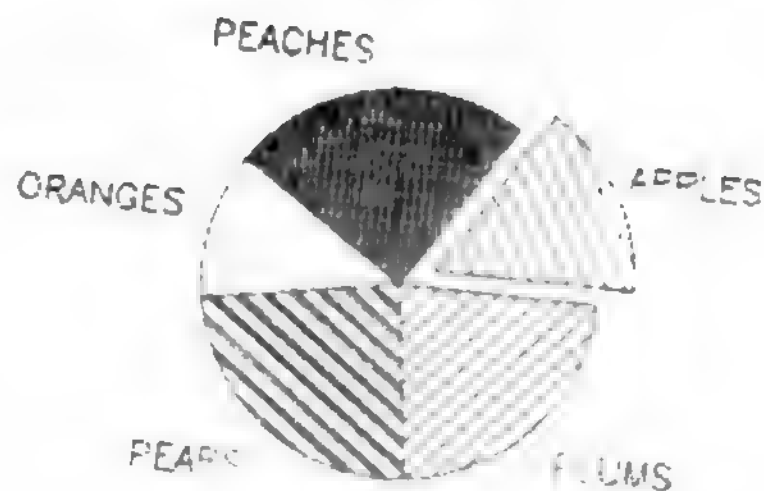
"Impossible," I would have said before.
"Impeccable," I say, now that I've bought your new dot matrix.

A dot that has two kinds of printout (graphics and text) for very little shell-out. That's impressive. And so very practical. A "two-in-one" fast dot. One that does everything I used to use two to do.

I was going to call you to congratulate you on your ingenious dot. But then I thought, and decided a letter would be more perfect.

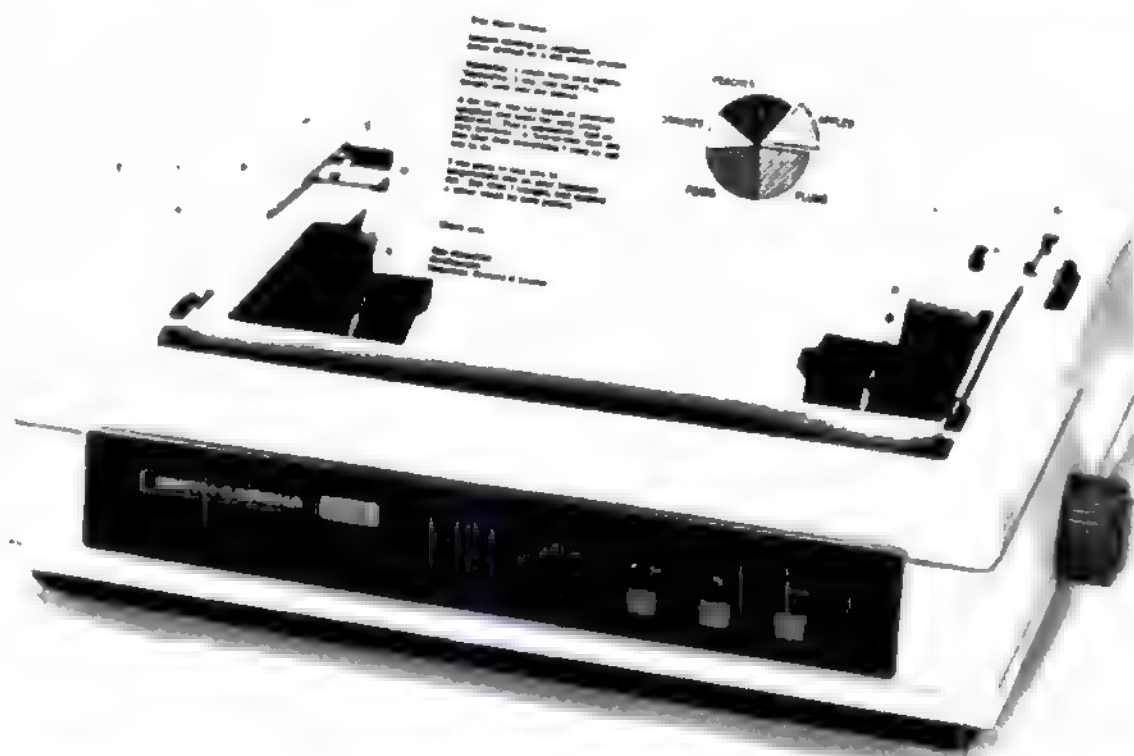
Thank you,

Ron Rosenfeld
Co-Chairman
Rosenfeld, Sirowitz & Lawson



At last, dot plus dash for very little cash.

The dot matrix printer with superb quality correspondence plus high-speed graphics. For under \$800.



Besides all the super high-speed graphics you expect, what else can you do with the Smith-Corona dual-interface D-200 dot matrix printer? You can print at a speed of 120 CPS (that's dash), with 80 characters per line. And you can write with quality. You can even use computer paper or letterhead with a removable tractor feed, which comes as standard equipment.

You can italicize to make a point. Emphasize to point out a good idea. Emphasize and italicize to make a point about a good idea. Enlarge if it's a big idea. Then subscript or superscript to make it all add up.

It's easy to see why so many people think a Smith-Corona printer is the one and only dot.

CIRCLE 157 ON READER SERVICE CARD



**SMITH
CORONA**

Pssst. It's time to

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CIRCLE 339 ON READER SERVICE CARD

SPECIAL ISSUE • DOT MATRIX \$1200 TO \$1999

Manufacturer	Model	Type	Price	Made in (country)	Dimensions (HxWxD)	Print (lines)	Rated CPS	Effective CPS	Notes
NEC Information Systems	P3 Pinwriter	Impact	\$1,250	Japan	4.9x22.4x13.1	24.3	180	82.2	20.3
Epson America, Inc.	LQ-1500	Impact	\$1,395	Japan	5.1x23.8x14.3	30.6	200	93.3	49.3
Printek	910	Impact	\$1,595	USA	6.9x23.1x17.0	35.0	200	143.8	N/A
Digital Equipment Corp.	LA 210	Impact	\$1,595	Taiwan	5.0x21.5x13.5	25.0	240	138.0	77.3
Datasouth	DS 180	Impact	\$1,595	USA	7.0x24.0x16.0	35.0	180	127.8	N/A
North Atlantic Qantex	7035	Impact	\$1,695	USA	8.0x24.0x16.0	42.0	180	123.3	37.1
Toshiba America	P1351	Impact	\$1,895	Japan	5.9x21.7x15.0	42.0	160	102.0	62.8
Printek	930	Impact	\$1,995	USA	6.75x24.0x16.7	35.0	200	111.3	55.6
Datasouth	DS 220	Impact	\$1,995	USA	7.0x24.0x16.0	35.0	220	150.1	45.4
North Atlantic Qantex	7065	Impact	\$1,995	USA	8.0x24.0x16.0	49.0	300	191.8	55.6
CIE Terminals	CI-3500 (Model 20)	Impact	\$1,995	Japan	4.7x22.5x16.6	38.5	350	246.6	N/A
Fujitsu America Inc.	DPL24	Impact	\$1,995	Japan	6.3x21.7x15.0	44.0	240	127.8	71.9
Comrex International, Inc.	ComRiter 420	Impact	\$1,995	Japan	7.6x23.4x16.0	59.1	417	230.2	80.3

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters.

which the CI-3500's manual calls "horizontal enlargement," since it spreads the letters to double width. The CI-3500 adds "vertical enlargement," which makes the letters twice as high. It can be used separately or in combination with horizontal enlargement.

With several consecutive lines of verti-

cal enlargement, you'll have to set the line spacing to more than 6 lines per inch. Luckily, this is no problem with the CI-3500. While the IBM, Epson, and compatible printers have control sequences for 6 or 8 lines per inch (as well as fractional amounts that require a calculation to set), the CI-3500 generously allows settings of

3, 4, 9, and 12 lines per inch.

Do you miss having Epson italics on the IBM printer because IBM substituted their special screen graphics characters? The CI-3500 has both. In fact, one control sequence allows you to select almost any combination of italic, vertically and horizontally enlarged, boldface, condensed,

	Rated DBA	Measured DBA	Measured OBC	Font Features	Line Feed	Line Pitch	Line Length	Line Spacing	Formatting Features	Smallest Horizontal	Smallest Vertical
Letter quality	62.0	78.0	77.0	UT,BT (O),RSS, RSF(O)	R	15.0	5,8.5,10, 12,17	H,V,C,U, S	P,LH,FL	N/A	1/240
Letter quality	N/A	81.0	80.0	UT(O), RSS, RSF (O)	R	15.0	5,8.5,10, 12,17	C,U,S	P,LH,FL, HT,VT	N/A	1/180
N/A	60.0	78.0	77.0	BT,PFR	B	15.0	5,6,6.6,8.3, 10,12,13.3,16. 7	C,U,S	LH,FL, HT,VT	N/A	1/16
Boldface, draft	65.0	81.0	77.0	UT,RSS, RSF(O)	R,B	15.0	5,8.5,10, 12,17	H,V,C,U, S	LH,FL, HT,VT	N/A	1/216
N/A	66.0	83.0	82.0	BT	F,B	15.0	5,10,12, 16.5	—	LH,FL, HT,VT	N/A	1/8
Letter quality	60.0	79.0	78.0	BT,RSS	R,B	15.0	5,10,12, 13.3,15, 17.1	H,C,U,S	J,C,LH, FL,HT,VT	1/120	1/144
High quality	64.0	78.0	76.0	BT(O), RSS, RSF (O)	R	15.0	5,8.5,10, 12,15	C,U,S	LH,FL, HT,VT	N/A	1/48
Executive quality	<60.0	79.0	78.0	UT,PFR, RSF(O)	B	16.0	10,12, 13.3,16.7	H,C,S	P,LH,FL, HT	N/A	1/8
Letter quality	62.0	86.0	85.0	UT	R,B	15.0	5,8.5,10, 12,17	H,C	LH,FL, HT,VT	N/A	1/217
Letter quality	60.0	78.0	77.0	BT,RSS, RSF(O)	R,B	15.0	5,10,12, 13.3,15, 17.1	H,V,C,U, S	J,C,LH, FL,HT,VT	1/120	1/144
N/A	58.0	75.0	74.0	BT,RSS	R,B	15.0	5,8.5,10, 12,17	H,C,U,S	LH,FL, HT,VT	N/A	1/216
Letter quality	<60.0	<60.0	<60.0	BT,RSS, RSF(O)	R	15.0	5,10, 12,18	H,C,U,S	P,J,C, LH,FL, HT,VT	1/120	1/180
Correspondence quality	60.0	72.0	71.0	UT,RSS, PFR	R,B	15.0	5,8,10,12,15	H,C,U,S	P,LH,FL, HT,VT	1/120	1/180

AF=Alternate fonts; AC=Alternate character set(s) IBM PC Compatibility: L=Low-order characters, H=High-order characters, C=IBM PC Graphics Printer command sequences. Graphics Compatibility: D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required, G=Incompatible graphics, V=Vendor-supplied software for compatible graphics. Ribbon or Refill Type: S=Spool, C=Cartridge, CL=Cloth, CA=Carbon, I=Ink jet refill, T=Thermal paper. Front Panel Controls: O=On/Off line, F=Form feed, L=Line feed, FL=Combined form and line feed, E=Error message and correction, P=Power-on settings. # Mixable Colors: MP=Multiple passes produce combinations. Ribbon Colors: A=Process, B=Process or primary. (O)=Optional

and elite type. When I succeeded in printing letter quality italics with horizontal and vertical enlargement at 3 lines per inch, I knew this was a printer that would provide lots of fun exploring the different available type faces.

One way in which the CI-3500 differs from the IBM Graphics Printer is that the

emphasized mode and the double-strike mode are identical to one another. Emphasized and double strike together look the same as either one by itself.

The CIE CI-3500 overcomes printer-compatibility problems by using ROM cartridges inserted near the rear of the machine. You replace these by opening

the cover, slipping one out, and putting another in. Different model numbers denote different cartridge combinations. The Model 20 is the PC-compatible machine. Additional font cartridges cost \$75 and printer compatibility cartridges are \$165 a piece. While some of the future models are still in the planning stages, it

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		IBM PC	IBM XT	IBM AT	Printer Size (bytes)	Type or	Price	Front Panel	
NEC Information Systems	P3 Pinwriter	DL,FL, AF	L,H	D	—	3,584	C,CL	N/A	O,L,F,E,P
Epson America, Inc.	LQ-1500	FL,AC	L,C	D	—	2,048	C,CL	N/A	O,L,F,P
Printek	910	DL,AF	L	G	—	1,792	C,CA	\$13.95	O,L,F,E,P
Digital Equipment Corp.	LA 210	FL,AF, AC	L,H	G	Epson	2,048	C,CL	N/A	O,L,F,E,P
Datasouth	DS 180	AC	L	G	Anadex	2,048	C,CL	\$10.00	O,L,F,E,P
North Atlantic Qantex	7035	DL,AF, AC	L	G	Diablo 630, Epson, Anadex	4,812	C,CL	\$12.00	O,L,F,E,P
Toshiba America	P1351	FL,DL, AF,AC	L	—	Qume Sprint 5	4,096	C,CL	\$14.00	O,L,F,P
Printek	930	FL,DL, AF,AC	L	G	Diablo	768	C,CL, CA	\$13.95	L,F,P
Datasouth	DS 220	FL,AF	L	G	—	2,048	C,CL	N/A	O,L,F,E,P
North Atlantic Qantex	7065	DL,AF, AC	L	D	Diablo 630, Epson	4,812	C,CL	\$12.00	O,L,F,E,P
CIE Terminals	CI-3500 (Model 20)	FL,AC	L,H,C	D	Epson	2,048	C,CL	\$35.00	O,L,F,E,P
Fujitsu America Inc.	DPL24	FL,DL, AF,AC	L	G	Diablo 630	4,096	C,CL	\$30.00	O,L,F,E
Comrex International, Inc.	ComRiter 420	AF	L	D	Epson MX-80	18,000	C,CL	N/A	O,L,F,P

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible; (3.0)=DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary (O)=Optional.

looks as if a single printer will be able to function with a variety of different computers by emulating a number of different printers. CIE is also planning to provide downloadable fonts.

I'm somewhat hesitant to mention the few problems I encountered, because this machine was still in the beta testing stage

when I reviewed it. But, if you're about to spend \$2,000 on this printer, there are a few things to check for before pulling out your credit card: On the machine I tested, the print quality was very sensitive to the paper adjustment lever; the paper separator bar in back leaned a little too much on incoming paper; and the paper occasional-

ly flew through the machine so fast it snapped at the perforations.

I was very impressed with the CI-3500. Breaking speed barriers with virtually complete IBM PC-compatibility makes it an excellent value. And its firmware expandability gives it an exceptionally bright future.—Charles Petzold

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Anadex DP 6500

One day I'll see a printer that's a great piece of hardware with a superb manual to accompany it. Unfortunately, that day is yet to come: It's not the Anadex DP 6500.

The good news is that the manual for the DP 6500 isn't bad. It's well organized, and the escape sequences are clear (al-

though some didn't work). A novice who understands the principles of escape sequences should have no trouble using this manual to configure software.

The bad news is that the printer itself fell seriously short of my expectations. The biggest disappointment was that although the manufacturer rates the DP 6500 at 540 cps in draft mode, our benchmark test produced only 215.8 cps. All the printers I tested produced lower cps rates on our test than the manufacturers adver-

tise, but this discrepancy was unusually large.

Also, I couldn't get boldface or shadow print to work in draft mode. However, I did get them to work in the 10-cpi double-pass mode. When I couldn't get italics to work, I called the Anadex technical support people; they told me that to print italics, you have to add 128 to the ASCII value published in the manual (Esc-T). Although Anadex claims that it has a new firmware that will produce italics without the change, the company could not give me a date for its release.

Another problem: I couldn't get the printer to print without smudging. It controls the distance from the printhead to the paper electronically rather than mechanically. No adjustment seemed to improve the print quality, however.

The DP 6500 has a typewriter roller as its standard equipment for handling paper. Both a bidirectional tractor (\$150) and a single-sheet feeder (\$995) are available.

Although Anadex clearly intends this printer to be used in a heavy-duty data processing environment, its price/performance ratio would be quite poor even if all the features worked as advertised. To make this unit worth the money, Anadex should eliminate the bugs and bring the printer's actual speed much closer to the advertised speed. —Gary Markman



DP 6500

Anadex, Inc.
20732 Lassen St.
Chatsworth, CA 91311
(800) 426-2339

List Price: \$2,995

CIRCLE 713 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Draft 10 cpi feature(s).
using the dual pass - proportional feature(s).
using the 12 cpi high speed feature(s).

Anadex WP 6000

Obscenities deleted, there aren't many words left to describe the WP 6000's manual. It leaves a great deal of room for improvement, to understate the case. If you—a computer novice, let's say—took a WP 6000 home expecting to open the box, read the manual, and configure your word processing software to talk to the WP 6000, you'd soon be torn between suicide and "printericide."

I had to call Anadex's technical support unit in California for assistance. With their help, I was able to get features such as underlining, italics, and double width to

work. All three features also worked in combination. However, I couldn't get condensed print in correspondence mode, nor could I figure out how to disable the superscript mode.

Oddly enough, WP 6000 implements superscript and subscript in the same way

The WP 6000 has promise, but at \$2,700 for the basic unit, I think the price/feature ratio is unbalanced.

it implements different typefaces. (Most printers treat superscripts and subscripts more like changes in pitch.) The printer's documentation includes proportional spacing, but I could not get it to work.

The benchmark test produced 150.1 cps in draft and 123.1 in correspondence mode. The WP 6000 has a standard typewriter roller; a bidirectional tractor (\$150) and an an single-sheet feeder (\$995) are optional.

The DIP (dual in-line package) switches, although easy to access, showed some peculiarities. Switch bank 1 is located inside the printer. Banks labeled 1 through 6 are at the rear of the printer. Notice I mentioned bank 1 twice? My best guess is that the bank labeled 1 on the inside is really bank 7.

Also, the ribbon comes packaged with a warning in big bold letters stating that the ribbon-head adjustment lever must be in the open-most position before you insert the ribbon. The impact of the message drives you to search long and hard for the adjustment lever (as I did). Surprise!



Wq



WP 6000

Anadex, Inc.
1000 Flynn Rd.
Camarillo, CA 93010
(800) 4-Anadex
(800) 792-9992 (inside CA)

List Price: \$2,700

CIRCLE 724 ON READER SERVICE CARD

using the Power On Default feature(s).

using the draft feature(s).

using the correspondence feature(s).

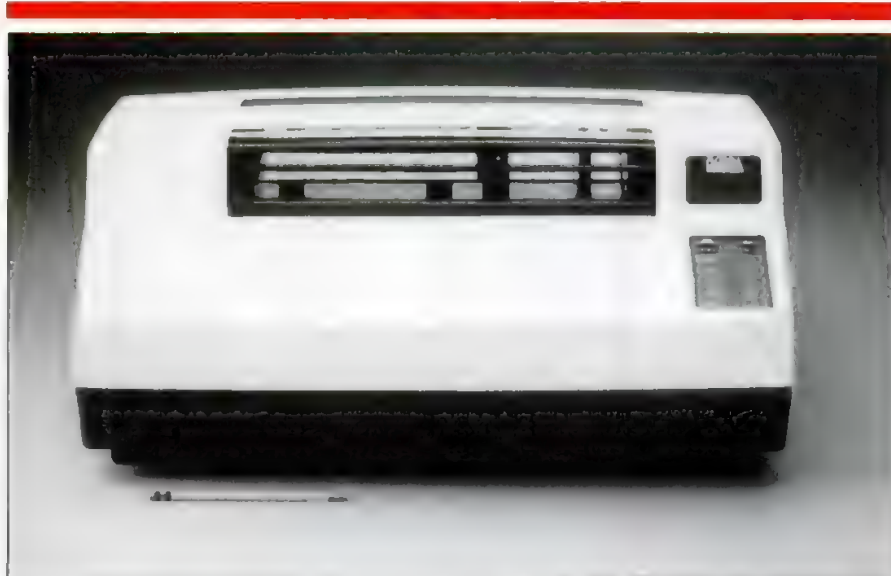
There isn't an adjustment lever. The head adjustment is accomplished electronically by a switch mounted on the front.

The WP 6000 has promise, but at \$2,700 for the basic unit (sans tractor), I think the price/feature ratio is too unbalanced. (Even if all the bugs were worked out and the manual redone, the price would be too high.) Other well-known printers in the same price range far outdistance this one on performance and ease of use.—Gary Markman

Florida Data OSP 130

First place in PC's Printer Project Salt Flats Speed Trials goes, uncontested, to the Florida Data OSP 130, which was the *only* printer to break 300 cps in our tests. Just like the muscle cars of the '60s, the OSP 130 is built to reach high speeds through brute power.

You pay for this power and speed, and



Wq



OSP 130

Florida Data
600D John Rodes Blvd.
Melbourne, FL 32935
(305) 259-4700
List Price: \$3,995

CIRCLE 685 ON READER SERVICE CARD

using the Power On Default feature(s).

using the bold feature(s).

the cost is not just the \$4,000 price tag. This printer was also one of the noisiest and most energetic ones we tested.

The normal noise problems of a dot matrix printer are compounded by the way this printer's casing has been designed. Since it handles both single sheets and tractor-feed paper, and the single sheets are ejected from the front of the top and fall into a bin, Florida Data had to put an opening right where the printhead is. Even worse, the top is bent to deflect the single

sheets forward and down into the bin, and this design seems to amplify the sound even more.

It should be noted that the single-sheet feature appears to work without a hitch. You place the paper in a cassette similar to a photocopier paper tray. It feeds the paper quickly, and it is possible to eject the last sheet without having to insert a new one. A comparison of the fanfold and cut-sheet speeds showed that there is a speed loss for using single sheets, but the printer still

managed better than 200 cps in this mode.

Besides noise, there is another physical problem. We set the printer up on a typical utility table. When we started printing, the whole table started to shimmy like a bad burlesque dancer. Before you install one of these, be sure you have a stand capable of holding an 85-pound hunk of machinery that is trying to shake the world.

The OSP 130 offers four separate fonts in ROM. Only the single-pass draft font is in 10 pitch. The double- and triple-pass fonts are both 12 pitch. There is also a single-pass 18-pitch font that could be useful for financial reports and spreadsheets.

The problem with the fonts is that they are really not of the quality I would expect from a \$4,000 printer. The draft fonts are poor, and the multiple-pass modes are no better than those of some printers that cost a third or less of what the OSP 130 does.

This printer has plenty of standard features and speed to burn. If speed is your

The normal noise problems of a dot matrix printer are compounded by the Florida Data OSP 130's casing design.

primary concern, the OSP 130 may be the printer you need. But given its rather loud and violent habits, I'm not sure I'd want one to move in next door or marry my computer.—**Alfred Poor**

Mannesmann Tally-440L

Mannesmann Tally's hefty MT-440L weighs in at almost 80 pounds. But even with all that bulk, it doesn't have much in the way of fancy frills, and some it does have could easily be done without. And it comes up short in several other ways, too.

Many of its printing and format features are programmable through the use of switches on the machine. But this feature seems superfluous in this day and age. I can't imagine that any device capable of sending a stream of data to this machine couldn't send it codes faster and more efficiently than manual programming can, and manual programming limits the printer to one task until you manually reprogram it.

I was also disappointed by MT-440L's almost total lack of graphics capabilities. The manual does show one graphics mode but it's not addressable by a normal escape code nor programmable from the front panel of the printer. You are forced to use a rather obtuse escape sequence format to get at the otherwise unaddressable graphics mode. Further, my attempt to use this graphics mode resulted only in a runaway paper feed that, within the couple of seconds it took to shut the machine off, created an awful jam.

One of the printer's unique features is an expanded mode for big characters, and I mean really big. It prints three-times, five-times, or even seven-times normal size, both in height and width. Not only are these characters rather useless, the letters are crudely formed. They are crude because the scheme used to form them simply involves printing each dot in a normal character as a box of up to seven characters in each direction. This method produces little square blocks of dots valiantly trying to fit together into a coherent letter or number. The characters don't look bad from 10 or 15 feet away, so

they're all right for posters and such, but not much else.

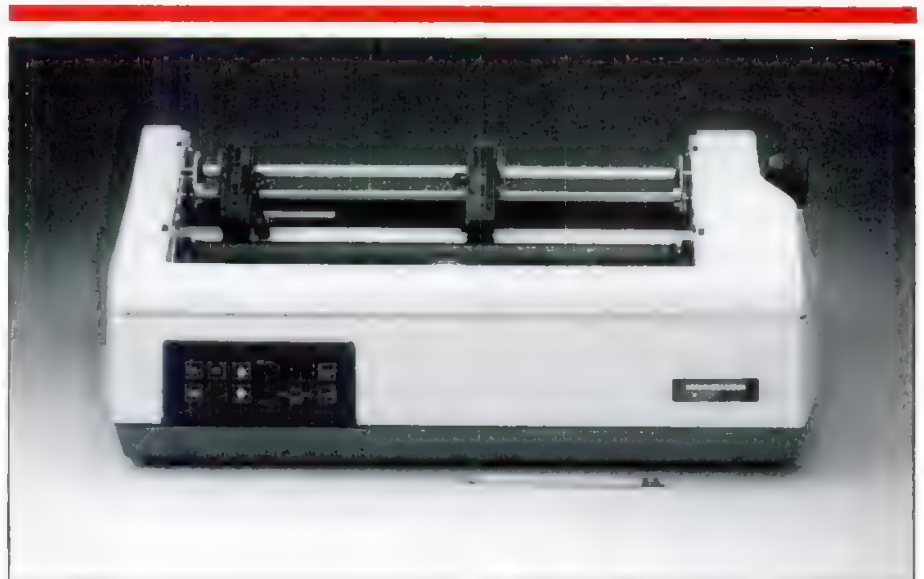
At least the MT-440L is fast. Tested at over 230 cps, this printer can grind out straight data as fast as you can produce it. Shifting to a higher dot density to produce correspondence quality output lowers the printer's speed to under 55 cps, but this is still quite good for correspondence quality printing.

On balance, though, it appears that Mannesmann Tally's engineering depart-

ment got a little carried away on this one and forgot the real purpose of an office printer.—**Jim Forney**

Newbury DRI 8850

The Newbury DRI 8850 dot matrix printer from England appears to be something of a masterpiece of overengineering. I say "appears" because the test model arrived with two pieces of docu-



Wq

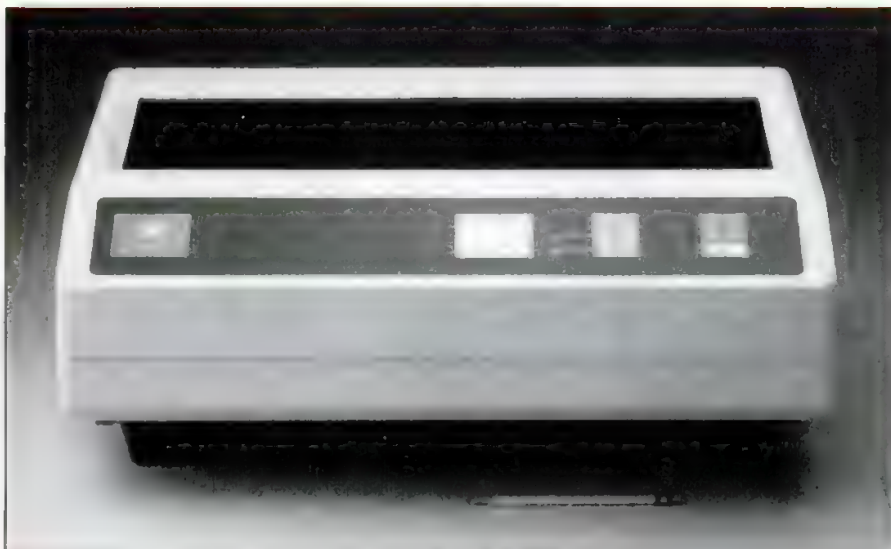
MT-440L

Mannesmann Tally
8301 South 180th St.
Kent, WA 98031
(206) 251-5500
List Price: \$2,695

CIRCLE 738 ON READER SERVICE CARD

using the Power On Default feature(s).

using the high density feature(s).

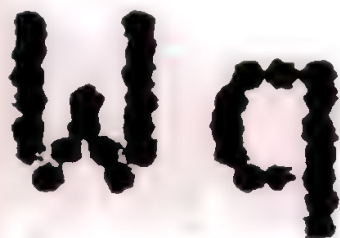


DRI 8850

Newbury Data Recording, Ltd.
Hawthorne Rd.
Middlesex, England TW183BJ
(0784) 61500

List Price: \$4,000

CIRCLE 797 ON READER SERVICE CARD



using the Power On Default feature(s).

mentation pertaining to four other models, but none specific to an 8850. A little checking revealed that it had come to PC after attending a convention in Las Vegas, and it must have been some party! It even had two printheads, though a close inspection revealed that they were both factory installed! More about that later.

Just opening the cover of the 8850 was a delight, like opening the hatchback of a beautifully crafted automobile. And I think I've ridden in several cars with less

interior room. It even has a pair of perfectly balanced gas-springs to hold the cover open in whatever position you leave it.

Printed on the inside of the cover is a full list of front-panel programmable feature commands: everything from form length to font and type size. But the documentation on how to use the four rather cryptically labeled control buttons that access all those features didn't survive the convention.

With a little dumb luck, I did manage to

bring the printer out of the kinky condensed default mode it learned in Las Vegas and bring it back to a sober 10 cpi. The 8850 seems to have a programmable set of nonvolatile, power-up defaults, which is only one of a number of nice features I would have liked to try. But the poor dear just wouldn't respond to most of the escape sequences in the only documentation I had, so I couldn't operate the features that were compatible with PC's standardized test routines.

Paper loaded easily from the bottom, and paper alignment did not seem critical, which is extremely important at high print speeds. On one high-speed run, however, I didn't have paper far enough out past the guides, and it jammed spectacularly. The machine just sat there trying to swallow something over 275 lines per minute until the program finished running.

I was also concerned about the alignment of the printer's two heads—one

The DRI 8850 came to PC after attending a convention in Las Vegas. It must have been quite a party!

prints the left side of a wide sheet, the other picks up the line in midstream and prints to the end. The idea is great and would obviously cut print times significantly on wide forms, but the alignment was off and the two sides did not line up on the model I tested. But, then, it was probably still hungover from that convention—and do you know where *your* printer is tonight?—**Jim Forney**

Pacemark 2350

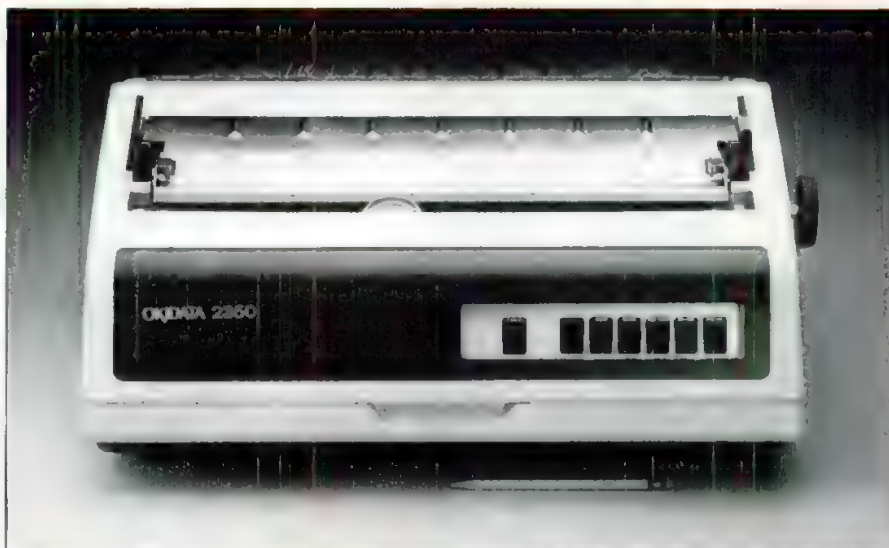
A peek under the hood of the Pacemark 2350 inspires the kind of awe and respect usually reserved for exotic 12-cylinder automobile engines. And just like the hood of a car, the 2350's cabinet has a spring hinge that tilts it open from the front, and it appears that your entire head and most of your torso could fit inside the resulting space. You just know this printer is going to be fast.

Indeed, this dot matrix model tools along at over 200 cps, its massive print-head shaking anything that isn't nailed to the floor, reversing direction almost faster than the eye can detect. At the rate the paper moves, I kept fearing paper jams, but the tractor-feed mechanism, adjustable from 3 inches to 16 inches, held up its end. It's a good thing, too, because the tractor feed is the *only* way to move paper. Single sheets and roll paper are not even offered as options. But at least 2350 accepts the fanfold paper.

The draft print mode can be used with six standard pitches from expanded/wide to compressed, and the print is darker and more legible than that of most printers in draft mode. This is also a good thing, because there is *no* correspondence quality mode, although the documentation leads you to believe otherwise. In fact, you cannot enhance the single pass of the print-head at all—no double strike, no emphasis, no great variety of type styles, no nothing—unless you can make your own by creating and downloading a better-looking character set.

The 2350 can underline, print subscripts and superscripts, and print in both red and black with a special double-ribbon cartridge. Still, the absence of a correspondence quality mode and the printer's inability to print emphasized or boldface type make the 2350 suitable only for straight data processing requiring decent, but not especially high-quality, output.

A great deal of attention was given to



Pacemark 2350
Okidata, Inc.
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(609) 235-2600
List Price: \$2,395

CIRCLE 775 ON READER SERVICE CARD

using the Power On Default feature(s).
using the none feature(s).

the layouts and diagrams in the documentation, but not much to the text. I can understand why this printer didn't inspire much good writing, though. When I called the company's technical representative and learned that Okidata's Pacemark 2410 does everything the 2350 does and delivers many of its missing features as well—all for only \$200 more—I asked him why anyone would buy the 2350. He couldn't think of a single good reason. And neither can I.—Phil Wiswell

Pacemark 2410

I spent so much time playing around with this amazing dot matrix printer that I almost missed my deadline—which leads me to pay the Pacemark 2410 the highest compliment I could give any printer: I wish I were printing both draft and final copies of all my reviews on it! They would look terrific and I would save a lot of time.

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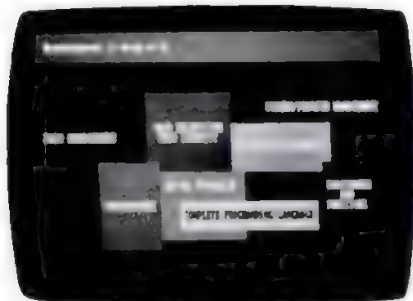
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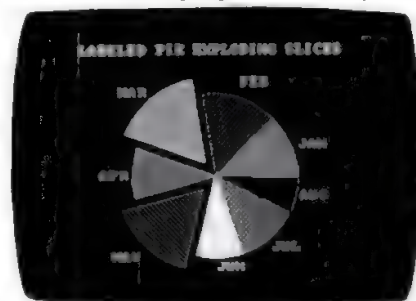
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too. (If you don't believe a fast printer can save you time in just a few thousand words, then you never saw the 2410 streaking along at an average of 203 cps in its data processing mode. You have barely enough time to dial the phone before it's on the second page of text.)

But what about print quality? The 2410 gives you three levels, data processing (fair), draft (good), and correspondence (excellent), which can be set by DIP switches or by software commands.

Page length, line spacing, and character pitch (10, 12, and 17.1 cpi) can be controlled by either method, too. This handy feature allows you to override your standard settings for individual printings, and the switches are conveniently placed in the front of the printer, under the top cover.

There is no boldface or emphasized print feature, but the quality of the correspondence mode type and the speed with which you can get it (almost 50 cps in my test) reduces that to a minor consideration.



Wq



Pacemark 2410

Okidata, Inc.
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(609) 235-2600

List Price: \$2,595

CIRCLE 773 ON READER SERVICE CARD

using the Power On Default feature(s).

using the draft mode feature(s).

using the correspondence quality feature(s).

The resident alternate character set provides a "shrunk" version of the standard set, most useful with subscripts and superscripts or with underlined material. The printer also has nine foreign-language character sets.

The 2410 has an unusual automatic paper gap adjustment, which lets you easily load carbon forms or paper of varying thicknesses. The bidirectional tractor feed offered minor problems with paper alignment in testing, but experience seemed to correct everything. You can feed single-sheet paper through the friction roller, or through the optional sheet-feeder attachment. A red/black ribbon cartridge for two-color printing is also optional.

This printer is large—put it on a small desk and you'll wonder where the desk went—but that's the price of the wide carriage, which can handle form-feed paper anywhere from 3 inches to 16 inches wide. Don't plan to move this printer around too often—it weighs a hefty 75 pounds.


Along with the standard on-line/off-line and line- and form-feed controls, the front panel also houses a status/fault display: a digital readout of error messages. Every printer should have one of these, yet most don't.

The very good manual easily dispels confusion regarding setup and operation. In fact, it's some of the better documentation I've read. But then the Pacemark 2410 is the best dot matrix printer I've seen. Now that I have used it, nothing else will ever be the same.—Phil Wiswell

Printronix MVP 150C

The Printronix MVP 150C heavy-duty line printer lists for \$2,995. That price is somewhat misleading, however, since Printronix's decision to locate the paper feed underneath the printer makes it necessary to spend \$60 on the optional desk-top feeder or \$200 on the optional printer stand.

I tested a prerelease model that came



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SPECIAL ISSUE

with documentation from the earlier version, the MVP 150B. The relatively simple installation procedure includes a minor, yet classy, feature. Printronix packages a moist towelette to use after installing the oversized spool ribbon. You'll need it, too, even though the ribbon installs easier than those on printers that use standard typewriter spool ribbons.

The ribbon-installation instructions were a little confusing, though. It did not immediately explain why the check light flashed as soon as I turned on the printer. This caused consternation until I discovered, several pages later, that the machine was simply out of paper. However, a wonderful diagram more than compensated for any imperfections in the written instructions.

Printronix advertises that the MVP 150C prints 200 lpm in draft mode and 80 lpm in correspondence quality mode. PC tested it at only 150.9 lpm in draft mode and 55.6 lpm in correspondence quality. (Using an 80-character line as the standard, the equivalent cps ratings are 201.2 and 74.1, respectively.)

The printer supports standard pitches of 10, 12, and 16.7 cpi with double width available in all pitches. Underlining, bold-face, superscript, and subscript are standard. Using the 150B documentation, I couldn't get the underlining to work. A Printronix representative told me that was because the 150C uses a different code for underlining. The 150C can also use Epson FX 80/100 escape codes to produce special print.

Print quality was adequate at best. The Printronix can't change pitch in the middle of a line. So, although you can insert underlines and boldface characters, you can't insert elite type in the middle of a pica line. The Printronix MVP 150C's ratio of cost to features is not impressive. You can buy several standard dot matrix printers rated close to 300 cps in draft as 65 cps in correspondence quality for under \$2,000. And many of them produce better print, have equivalent features, handle single-sheet paper (which the Printronix can't



MVP 150C
 Printronix
 P.O. Box 19559
 Irvine, CA 92713
 (714) 863-1900
 List Price: \$2,995

CIRCLE 788 ON READER SERVICE CARD

using the Power On Default feature(s).
 using the 10 cpi Correspondence quality featur
 USING THE COMBINE EMPHASIZED/DOUBLESTRIKE FEATURE(S).

do), and can change pitch and font in the middle of a line. And, since they use cartridge ribbons, you can save your moist towlettes for real emergencies.

—Gary Markman

Printek 920

The Printek 920 was the first printer tested for this issue. It was also the first of many to require an emergency call to the

manufacturer because of an insurmountable problem. The 920's problem consisted of generating device-timeout errors on the PC.

A Printek spokesman explained that the fault lay with a chip supplier, which had changed the manufacturing process, affecting the chip's performance. New chips were being installed, but PC must have received a printer with one of the older chips. A few days later, a replacement 920 arrived.

(continued)

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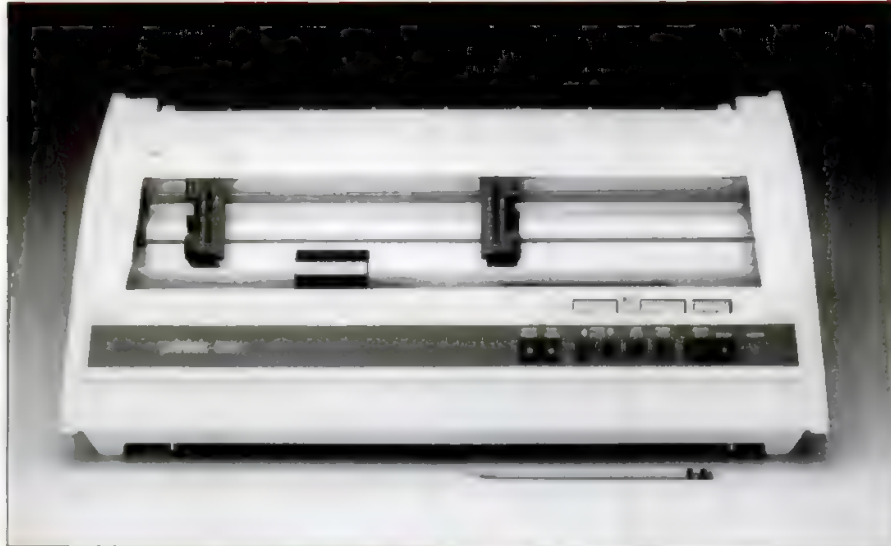
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 (616) 925-3200
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CIRCLE 766 ON READER SERVICE CARD

Wq

using the Power On Default feature(s),
 using the correspondence quality font 1 featur

The replacement almost solved the problem, but the Printek 920 still caused a device-timeout error when running through the highest print-quality speed test. The Printek spokesman now laid the blame on the IBM PC, which requires printers to acknowledge commands within 6 seconds. Printek sent me a utility that replaced the PC's BIOS print program and stretched that time period to 60 seconds. You'll need that program if you buy this printer.

The Printek 920 is a medium-level dot matrix printer that offers a few advanced features, such as the ability to download character sets. It lacks many enhancements found in less-expensive printers (for example, proportional spacing and bold-face print). In addition to draft quality, the printer can be set for near-letter quality correspondence printing using the DIP switches. The tested draft-quality speed of 203 cps is quite respectable.

Although the Printek 920 has a graph-

ics mode, it is incompatible with the PC's. The spokesman said that the company had no plans to provide any software that would remedy this. He noted, however, that the printer is 1-2-3 compatible.

Overall, the Printek 920 is well designed. The control panel's collection of nine buttons and lights provides error messages, mode-selection readings, and line- and form-feed operations. The DIP switches, located beneath the cover just above the control panel, are easily accessible. A chart explaining each of the possible DIP settings is printed on the inside of the cover.

As a safety feature, the printer goes off-line when you open the cover; but this makes it difficult to align the paper through the tinted plastic. The paper feeds through the printer's bottom—front, rear, or center. The bidirectional tractor feed allows alignment in either direction in 1/72-inch increments. The printer uses a popular and relatively inexpensive (\$13.95) brand of ribbon cartridge, so replacements shouldn't be a problem.

The real question is whether the Printek 920 is worth its \$2,395 price tag. Although it can double as a draft and correspondence printer, I think \$2,400 is too much for a machine that needs a special utility to print without causing a device timeout.—**Vincent Puglia**

Santec Variflex S700

The impressively made Variflex S700 features interchangeable ROM cartridges offering up to 32 different fonts, and graphics too. The print sample included in the package was just about the best quality I've ever seen from a dot matrix printer. Its advertised speed of 390 cps in draft mode and 58 cps in some of its letter quality fonts (32 cps in others) made me anxious to see this one hum. It even had a cartridge ribbon.

Had I finally found the printer of my dreams? Not yet—the Variflex S700 has some serious problems. The table of con-

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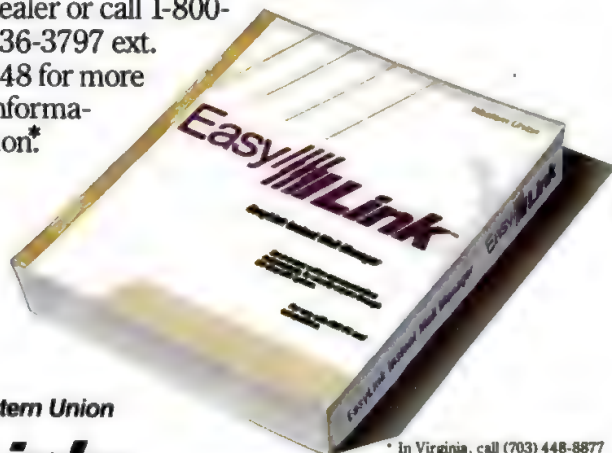
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tents in the manual doesn't quite correspond to the pages inside, but that was almost helpful, considering the manual itself. The descriptions of the escape codes for changing fonts must have been written by a sadist. I don't mind writing escape codes in hex, or in ASCII, or even just being told which keys to press. I'm easy. But, "Esc t(n) where bit 5 of parameter n=1" is cruel! That bit of advanced Greek was supposed to select draft mode of a particular font. It didn't. Even though I tried *n* values of 0, 32, 64, and all points in between, I had no luck.

I did get the machine to print boldface, but then I couldn't get it to stop. It didn't underline when I told it to, and then it started underlining when I told it not to. It started reminding me of my son. (The manufacturer claims that its most recent model will be compatible with Epson and Diablo 630 escape codes.)

Another mind bender was that after each form feed, the printer hopped into the off-line mode. At least it sharpened my reflexes because I had to hit the on-line button before DOS detected the off-line condition from the printer and bombed the testing software with a device-timeout error.

On a subsequent call to Sante Corporation I was told that I had to set one of the DIP switches to tell the printer that continuous forms were being used. However, that information was not at all obvious in the manual.

Then there's the paper. The printer comes with a standard friction feed (typewriter-style roller)—a forms tractor is optional. Using the roller with continuous forms resulted in the paper riding to the left and finally jamming. I've used continuous forms on a roller on other printers and had no problem.

Fortunately, the Variflex S700 does have some positive aspects. Its print quality in letter quality modes was excellent. You can easily select the different font cartridges from switches at the front of the printer. An intelligent machine, it can actually detect if the paper isn't straight.

(Unfortunately, it usually ends up crooked anyway.) The Variflex S700 displays appropriate error codes on the front panel when it detects an error condition, and the manual explains the codes clearly (and on the proper pages).

At present, the Variflex S700's value-to-feature ratio is unacceptable. The basic unit costs \$3,600, the bidirectional tractor is an additional \$200, and additional fonts (each including fonts for both letter quality and draft modes) are approximately \$55

each. If the printer delivered its advertised speed, perhaps I'd be more enthusiastic, but our benchmark test produced speeds of just 101.5 cps in draft mode and 23.3 cps in letter quality.

When the manufacturer designed the Variflex S700, it obviously had a high-quality, heavy-duty machine with many reliable features in mind. For this printer to fit the bill, however, the bugs must be ironed out, the true speed increased, and the price dropped.—Gary Markman




FACT FILE

Variflex S700
Sante Corporation
9 Columbia Drive
Amherst, NH 03031
(603) 882-1000
List Price: \$3,600

CIRCLE 770 ON READER SERVICE CARD

using the Power On Default feature(s).

A high jumper in mid-air, performing a Fosbury Flop over a bar. The athlete is wearing a red singlet with a white logo on the back. The background is dark with large white letters 'J A V' visible at the top.

J A V

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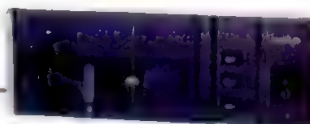
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SPECIAL ISSUE • DOT MATRIX \$2000 AND UP

Manufacturer		Type	Price (country)	Dimensions H x W x D (inches)	Weight (pounds)	Rated CPS	Effective DPI	CPS Quality	
Okidata Corp.	Pacemark 2350	Impact	\$2,395	Japan	9.1x23.6x20.5	72.0	350	203.1	N/A
Printek	920	Impact	\$2,395	USA	6.9x23.1x17.0	35.0	340	203.1	N/A
Okidata Corp.	Pacemark 2410	Impact	\$2,595	Japan	9.0x23.5x20.2	74.0	350	203.1	48.6
Mannesmann Tally	440L	Impact	\$2,695	Switzerland	9.4x26.3x18.2	79.5	400	230.2	54.8
Anadex	WP 6000	Impact	\$2,700	USA	8.9x29.5x18.4	62.0	276	150.1	123.3
Printronix	MVP 150C	Impact (line)	\$2,995	USA	10.5x24.6x20.7	60.0	200 LPM	104.6	24.7
Anadex	DP 6500	Impact	\$2,995	USA	8.9x29.5x18.4	55.0	540	215.8	107.9
Santec Corp.	Variflex S700	Impact	\$3,600	USA	7.6x22.5x18.5	52.0	390	101.5	23.3
Florida Data	OSP 130	Impact	\$3,995	USA	9.5x25.0x28.0	85.5	600	314.0	33.5
Newbury Data Recording, Ltd.	DRI 8850	Impact	\$4,000	England	8.6x26.8x18.5	52.0	N/A	181.7	N/A

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters;

DOT MATRIX OVERVIEW • JOHN DICKINSON

CONNECTING THE DOTS

For this issue, *PC Magazine* tested a great number of dot matrix printers. A considerable number of these machines should provide many years of good printing service, and a few are

truly outstanding values. Since part of the purpose of this special issue is to help you narrow down your choices when looking for a printer, *PC's* editors and reviewers selected the outstanding dot matrix print-

ers in each price category.

In making the final selection for the top spots, we pored over the performance and feature data in the charts but also considered the reviewers' observations on the printer's ease of setup and use. A good dealer can help you overcome setup and compatibility problems, but if you can take the printer out of the box and use it without much further ado, so much the better.

Like the study of dot matrix printers itself, these outstanding printers have been arranged in ascending price categories.

UNDER \$800

Budget-priced dot matrix printers, like

	Rated DBA	Measured DBA	DRC	Page Feed	Line Source	Carriage Width (Inches)	Type Pitch(es)	Printing Speed	Connectors Features	Horizontal Increment	Smallest Increment
N/A	62.0	78.0	77.0	UT	R,B	15.0	5,6,8,5,10, 12,17.1	U,S,R	LH,FL, HT,VT	N/A	1/144
N/A	60.0	77.0	76.0	BT,PFR	B	15.0	5,6,6,6, 8,3,10,12,	C,U,S	LH,FL, HT,VT	N/A	1/16
Correspondence quality	62.0	78.0	77.0	BT,RSS, RSF(O)	R	15.0	13,3,16,7 5,6,8,5,10, 12,17.5	C,U,S,R	P,LH,FL, HT,VT	3/120	1/144
High density	<60.0	76.0	75.0	UT,RSS	R,B	15.0	5,8,5,10, 12,17	H,C,U,S	HT,VT	N/A	N/A
Correspondence mode	65.0	81.0	80.0	BT(O), RSS, RSF(O)	R,B	15.0	5,8,5,10, 12,17	H,V,C, U,S	P,J,C,LH, FL,HT,VT	N/A	N/A
Correspondence, double strike	N/A	79.0	79.5	HT	F,B	15.0	5,8,5,10, 12,16.7	H,V,C,S	J,C,LH, FL,HT	N/A	1/72
Double strike	60.0	86.0	85.0	BT(O), RSS, RSF(O)	R,B	15.0	5,8,2,10, 12,16.4	H,V,C, U,S	J,C,LH, FL,HT,VT	N/A	1/98
Letter quality	60.0	74.0	73.0	BT(O), RSS, RSF(O), RP(O)	R	15.0	6,8,10,12, 14,15,18	H,V,C, U,S	J,C,LH, FL,HT,VT	N/A	1/128
Triple-pass bold	61.0	82.0	81.0	UT,RSS, RSF	R,B	15.0	5,10,12	H,C,U	P,J,LH, FL,HT,VT	1/60	1/48
N/A	N/A	68.0	70.0	BT,PFR, RSS	B	15.0	5,10,12,16	R	LH,FL, HT,VT	N/A	1/8

AF=Alternate fonts, AC=Alternate character set(s) **IBM PC Compatibility:** L=Low-order characters, H=High-order characters; C=IBM PC Graphics Printer command sequences **Graphics Compatibility:** D=PC-DOS graphics command compatible, (3 0)=DOS 3.0 required, G=Incompatible graphics, V=Vendor-supplied software for compatible graphics **Ribbon or Refill Type:** S=Spool, C=Cartridge, CL=Cloth, CA=Carbon, I=Ink jet refill, T=Thermal paper. **Front Panel Controls:** O=On/Off line, F=Form feed, L=Line feed, FL=Combined form and line feed, E=Error message and correction, P=Power-on settings. **# Mixable Colors:** MP=Multiple passes produce combinations **Ribbon Colors:** A=Process, B=Process or primary (O)=Optional

economy cars, form a category with a large and interesting variety of choices. Like their four-wheeled friends, there is intense competition among low-priced dot matrix printers to give the most features for the fewest dollars. Although no one printer could clearly be called *the* outstanding economy class printer, it became clear that there were winners at each \$100 break point in the price scale—starting at \$300. That made things easier for us, and for you—you can now select a quality printer that lands squarely in your budget plans.

Centronics GLP—\$299

Centronics's minuscule GLP is the closest thing you'll find to a disposable

correspondence quality printer. If you outgrow it in a couple of years, you won't feel guilty about replacing it with a more expensive one—or just handing it down to the kids!

The GLP is tiny and light, making it perfect for the space-conscious office or home user, or for the traveler with a trans-portable or lap computer. Its compatibility with the IBM PC character set and graphics, and with IBM's PC Graphics Printer command sequences, make it ideal for PC users. Most applications will work directly with the GLP without modification or patching. Its low price also makes it a reasonable choice as a second printer for those who have occasional need for a purely PC-compatible printer.

The GLP is not fast, but its price, correspondence quality printing, compatibility with the PC, and convenient small size more than make up for that. It's the unquestionable *buy* of all the printers tested. As for the GLP Centronics sent to *PC* for testing, well . . . it's tucked into a tote bag next to my lap computer, and Centronics shouldn't expect it back!

Epson RX-80—\$399

What would life be like without Epson printers? The RX-80 is the faster and less expensive successor to the legendary MX-80 printer that brought dot matrix printing to untold numbers of microcomputer users—both before and after IBM got into the business. At \$399, it's hard to beat.

SPECIAL ISSUE • DOT MATRIX \$2000 AND UP

Manufacturer	Model	Alternate Characters	IBM PC Compatibility	Printer Language	Other Printer Compatible	Buffer Size (bytes)	Ribbon Type or Refill Type	Ribbon or Refill Cost	Front-Panel Controls
Okidata Corp.	Pacemark 2350	DL,AC	L	—	—	2048	C,CL	\$30.00	O,FL,E,P
Printek	920	DL,AF	L	G	—	1792	C,CA	\$13.95	O,L,F,E,P
Okidata Corp.	Pacemark 2410	AF,DL,AC	L	V	—	2048	C,CL	\$30.00	O,E,P
Mannesmann Tally	440L	FL	L	—	—	2048	C,CL	N/A	FL,E,P
Anadex	WP 6000	FL,DL	L	V	Diablo 630	4608	C,CL	\$14.00	O,L,F,E,P
Printronic	MVP 150C	—	L,H,C	D	Epson FX-80	1024	S,CL	\$9.95	O,F,E,P
Anadex	DP6500	FL	L	G	—	4096	C,CL	N/A	O,L,F,E,P
Santec Corp.	Variflex S700	AF,AC	L	G	Epson, Diablo 630	2048	C,CA	\$5.25	O,L,F,E,P
Florida Data	OSP 130	DL,AF	L	G	—	512	C,CL	\$12.00	O,L,F,E,P
Newbury Data Recording, Ltd.	DRI 8850	FL	L	G	—	N/A	C,CL	N/A	O,L,F,E,P

Paper Feed: UT=Unidirectional tractor, BT=Bidirectional tractor, RSS=Roller, single sheet, RSF=Roller, sheet feeder; PFR=Pin-feed roller, RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis, V=Vertical emphasis, C=Correspondence quality (matrix); U=Underline, S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines, C=Centered lines, LH=Variable line heights, FL=Variable form length, HT=Horizontal tabs, VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts, AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters, H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required, G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge, CL=Cloth, CA=Carbon; I=Ink jet refill, T=Thermal paper. **Front Panel Controls:** O=On/Off line, F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process, B=Process or primary. (O)=Optional.

Its framework and case are almost identical to the MX-80's, and it includes the nearly jam-proof Epson FT paper-feed roller/tractor combination. Being an Epson, the RX-80 includes PC-compatible graphics and follows nearly the same command sequences used in IBM's variant of the MX-80. Many software authors have overcome these subtle differences and adequately support both printers.

The RX-80 is not without drawbacks. Its print quality is not extraordinary; its character set uses italics instead of the IBM PC's graphics characters (of course, you may prefer this); and its raspy voice may irk you. You can overcome the character set incompatibilities by spending \$50 more to buy IBM's PC Graphics Printer,

but you'll lose some speed in the process.

All that aside, if \$399 is your price, the RX-80's your printer.

Olympia Electronic Compact NP—\$499

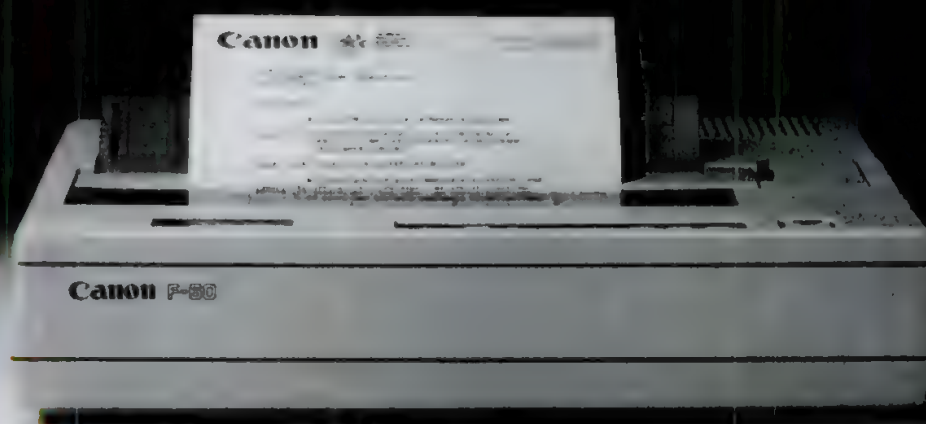
This German-built beauty is a real sleeper. You've probably never heard of it, and you would probably pass it over among the myriad of similar-looking machines at your local computer store. But if you give it a chance, the Olympia Electronic Compact NP will wake itself, and you, right up. The print quality is excellent, the speed is high and noise level low. You'll notice all that as soon as you run the self-test.

Even better, the Electronic Compact NP's clearly written manual is a model for the industry to follow—it tells you, in not too many words, exactly what you need to know to set up your printer and run it with your favorite software packages. And the printer is chock-full of features.

The Electronic Compact NP works with most applications designed for IBM or Epson printers; its graphics are compatible with the PC and have additional features to go with its excellent print quality. To top things off, at an effective 80 cps the Electronic Compact NP was the fastest \$499 printer tested.

This printer is a sure thing if it falls into your price range—and even if it doesn't, it may be worth considering anyway.

How does a new, letter-quality, thermal transfer printer made by Canon sound? Very quiet.



Canon's advanced non-impact printing technology heralds yet another achievement—The F-60: a flexible, high-quality thermal transfer printer with Graphic Image capability.

Its letter-quality printing is good enough to use with a word processor, yet quiet enough to be seen and not heard. The F-60 operates at a dramatically low 45db, so it's perfect for even the most noise-conscious office.

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The F-60 is also highly versatile. It handles not only thermal paper and overhead projection film, but also plain paper in single sheets, rolls or fan folded. Its self loading mechanism automatically inserts and advances the paper. It's even compatible with most leading personal computers.

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For upgraded performance, optional accessories include pin feed, tractors, roll paper holders and a serial interface card.

The new F-60 thermal transfer printer from Canon. You have to admit it sounds very good.

For more information:
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(In Illinois call 1-800-942-8881, Ext. 300.)
Or write Canon U.S.A., Inc.,
Printer Division, P.O. Box CN 11250,
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Canon Printer Division

Okidata Microline 92—\$599

If you want nearly pure IBM PC compatibility, correspondence quality output, and outstanding performance, Okidata's

Microline 92 with Plug 'n' Play PC-compatibility chips installed may be the printer for you. Or, if you don't care about compatibility, but do want elite (12 pitch)

printing and downloadable character sets, look at the M92 without Plug 'n' Play. If you want both, try on the standard model and go the extra \$50 for the Plug 'n' Play chip kit—it takes only minutes to switch the chips.

Whatever you do, don't pass over this printer! The outstanding quality of the Okidata Microline 92's design and construction is reflected in the accurate tracking of its printed characters. If you print a large table of numbers with commas and decimal points, they will line up perfectly; even the vertical bars of the IBM PC text-graphics characters will be perfectly aligned. And, to top things off, it offers outstanding speed for its price.

The only strike against the M92 (and all Microlines for that matter) is their spool ribbons. Unflagging Okidata fans insist this archaic design minimizes ribbon replacement costs, but is it really worth the frustration, wasted time, and huge quantities of Borax needed to wash up with after you change the ribbon?

You can buy the M92 in a wide-carriage version (the M93), but that will push you into a loftier budget category. If the standard-width carriage will do the job for you, buy the M92—and rubber gloves to go with it!

Practical Automation 8-PLP—\$728

Practical Automation's 8-PLP packs a lot of punch for the price. You'll need a much thicker wallet to beat this little wonder's 136-cps effective speed. It also has the winning combination of rugged construction and portability.

The only thing the 8-PLP lacks is print enhancement features—it can change print pitch, but can't make characters darker or prettier. It doesn't print graphics either. If you need a low-cost printer, however, and your only requirement is the speed necessary to print out hordes of mailing labels or invoices, don't pass this one up. All that's left is for Practical Automation to come out with an equally speedy model offering a full complement of PC-

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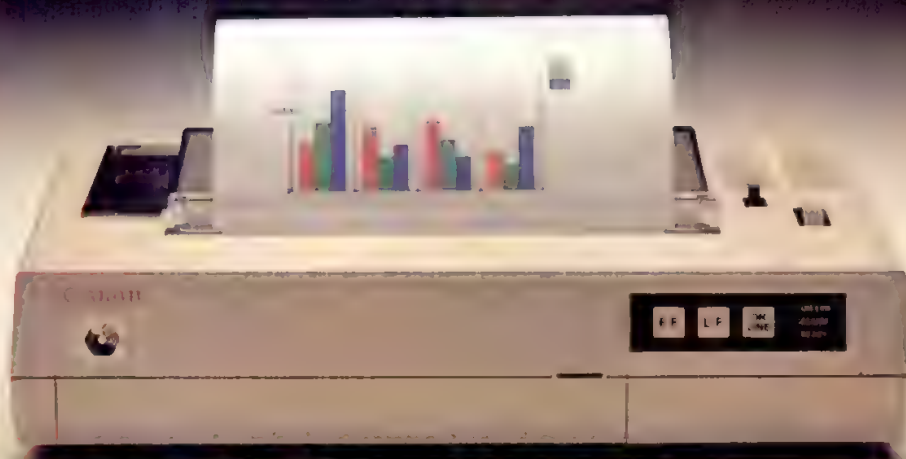
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Canon Printer Division

CIRCLE 203 ON READER SERVICE CARD

Smith-Corona D300—\$795

Smith-Corona appears to be abandoning its stodgy image as a typewriter maker and entering the modern world of PC-

compatible dot matrix printer makers. If its D300 is any example, the company is capable of offering good performance and value for the matrix-printer dollar.

The D300 is the only economy-class printer with a wide (15-inch) carriage we can seriously recommend. It's fast (at an effective speed of 108 cps), chock-full of good features, offers proportional spacing to match its correspondence quality, and features adequate PC compatibility. Its graphics and command sequences are compatible with IBM's printer. The only thing missing is a compatible high-order character set.

It uses single sheets or continuous fan-fold paper, and the wide carriage delivers over 230 characters per line in compressed print mode. At \$795, the D300 can't be beat!

\$800 TO \$1,200

Printers in this class generally offer more correspondence quality print features than their economy-class brethren but are similar in terms of compatibility and speed. If high-quality dot matrix printing is what you're looking for, this is a good price range for you to check out. There were two clear winners in this category.

Toshiba P1340—\$995

Toshiba America is out to convince the world that fully formed character printers are no longer needed, and it's doing a credible job with the P1340 (and its big brother, the P1351).

The P1340 is an easy printer both to set up and use, as long as you're not in a hurry for output and have compatible software to drive it. It's not fast, nor is it as flexible as many of its less-expensive competitors. It's not fully IBM PC-compatible in the areas of character set, command sequences, or graphics. But those are not the qualities Toshiba's designers had in mind for their junior matrix printer.

Toshiba designed the P1340 to produce typewriter quality printing and to behave like a Qume Sprint 5, making it compatible with a large number of word processing programs. It does both jobs remarkably well.

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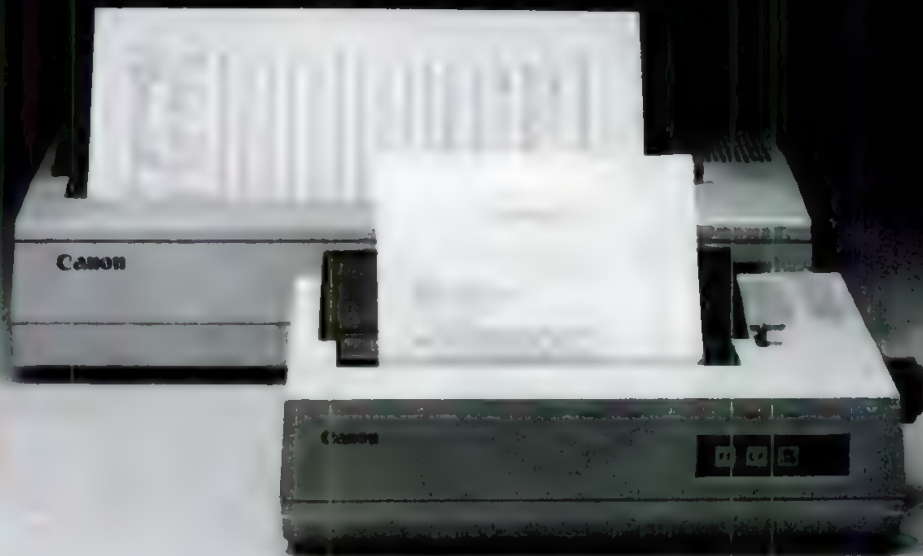
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CIRCLE 202 ON READER SERVICE CARD

Canon Printer Division

Texas Instruments 855—\$935

The TI 855 is a reasonably priced correspondence quality matrix printer, featuring numerous interchangeable plug-in font cartridges. Although its 108-cps default mode slows to a crawling 15 cps when more than one of its quality features is enabled, the quality of both its correspondence mode and draft mode output are excellent, with any font.

My only reservation about the TI 855 stems from problems the reviewer had with its battery of membrane switches. They were hard to use and made contact only after a severe pummeling. A little investigation turned up several users around PC's offices who had experienced severe reliability problems with TI 855s because of the switches. Come on, TI, put some decent switches in there and make it last—the TI 855 is too good to get bad marks.

\$1,200 TO \$2,000

Hold on to your wallets because things start to get serious about here! The printers in this class combine high performance and high-quality printing in ways that ought to keep manufacturers of state-of-the-art printers on their toes. There are a couple of printers in this category that I don't think you'll want to live without.

Toshiba P1351—\$1,895

If you want a combination of high-speed and correspondence quality printing, the Toshiba P1351 is your printer. Like its little brother, the P1340, it's not as PC-compatible as you might like, but it does its job of Qume-compatible, correspondence printing even better.

And it's fast. Only one fully formed

character printer we tested (the Fujitsu SP830) could match its 62.8-cps speed in correspondence quality. They all matched its print quality, but that's only a backwards way of saying how good the quality of the P1351's output is. The P1351 adds downloadable characters to its array of features, and tractor- and sheet-feed options are also available.

When Toshiba America called to see if there were problems testing their printers, I responded, "You bet—I can't get the P1351 off Bill Machrone's desk long enough to get its picture taken!"

It's that good.

CIE Terminals CI-3500 (Model 20)—\$1,995

The CI-3500, a new barn burner from CIE Terminals (a new subsidiary of C. Itoh), should have the printer industry

In the beginning,
man discovered
some jobs were
bigger than others.

It didn't take long before man
asked his micro computers to
do more.

More and more reports.

Longer and longer documents.

Soon man's printers hummed
along, page after page, hour after
grueling hour.

Until some of them stopped.
Dead in their tracks.



quaking in its boots. At 247 cps, it was the second-fastest printer tested in Project Printers, and speedy printing is not its only asset.

The CI-3500 is IBM PC Graphics Printer-compatible (including the high-orders characters) and produces perfect graphics. You can control its command sequences by changing one cartridge, and changing another cartridge alters its fonts. It produces excellent correspondence quality output, and it's quiet, relatively small, and light. All for only \$1,995.

The only reservations I have about the CI-3500 stem from the beta-test status of the one PC tested. A CIE official claims the company has fixed the one bug we found and swears on a stack of ribbon cartridges it'll stick to the incredibly low price. The official also assured me of national distribution by the printer's mid-October release date, so you should be

able to get one by now.

Let's hope so—I want the first production model off the line!

\$2,000 AND UP

There isn't as much to choose from in this price class as you might expect. The edge these printers once had over their lower-priced kin is fast eroding as competition and technology drive prices down and features up. I do have, however, one strong, but qualified, recommendation.

Okidata Pacemark 2410—\$2,595

The Okidata Pacemark 2410 looks like a cross between an earthmover and a racing car. At 74 pounds, it weighs like the former, and at 203 cps, it moves like the latter. But in its 49-cps correspondence quality mode, the 2410 lays dots down on

paper almost as gracefully as any correspondence quality dot matrix printer.

The printer is built to last. It reminds one of the machinery in a fine European luxury car, and it never complains, even when asked to print for days on end.

Unfortunately, the competition is quickly catching up, and at a lower price, with Okidata's dream machine. And Okidata has done nothing to fill up the empty chip slots on its massive system board. The only option offered to date is the impossibly-difficult-to-use downloadable correspondence quality character-set option.

Come on, Okidata—where are the 2410's Plug 'n' Play chips? Where are the new correspondence quality options like boldface and shadow printing, true proportional spacing, and alternate character fonts? Why not add color capabilities? Competition's nipping at your heels. ■

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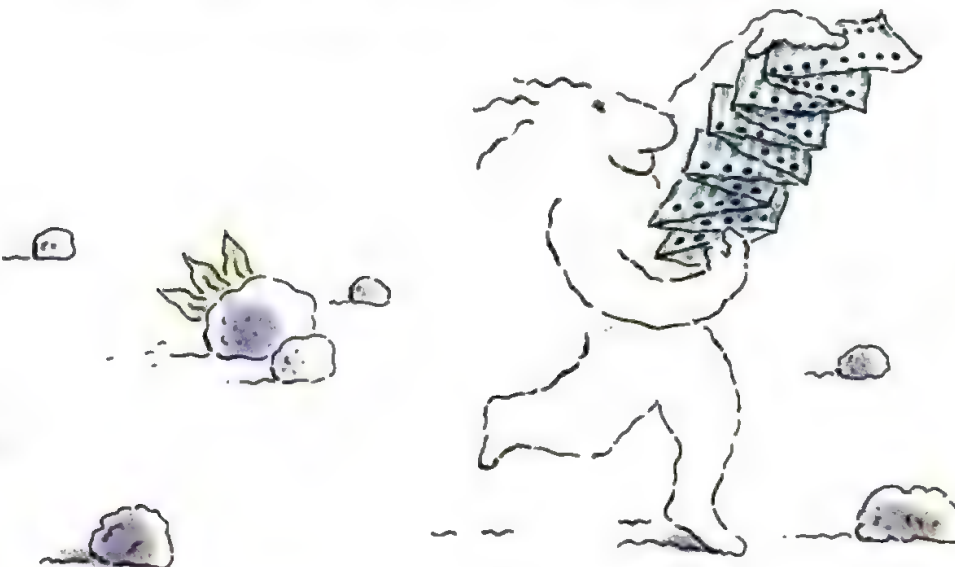
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FULLY FORMED PRINT:

Nothing in this industry stays still for long—including definitions it seems. Today's crop of laser printers, high-resolution dot matrix printers, and other technological marvels has blurred the distinction between letter quality, correspondence quality, and typeset quality printing.

It wasn't long ago that letter quality output meant "indistinguishable from that of a Selectric typewriter." Correspondence quality was one notch down the scale but still highly readable. Typeset quality was one large step up the scale and was reserved for honest-to-goodness typeset materials such as books.

Today "letter quality output" is coming to mean anything that is easily readable: laser printers produce "letter quality" text that looks like a photocopy of typeset material. Dot matrix printers produce "letter quality" text in which you can see the dots if you look closely.

This wider definition of letter quality will most likely win out. But for the moment, many users still are put off by anything other than Selectric-style output. The only way to get true letter quality printing is to use a printer that works more or less the same way as a Selectric typewriter.

The IBM Selectric typewriter has a print element—the infamous "golf ball"—that contains a set of fully formed characters. When you press a key, the ball rotates to the character you want, then bangs that character hard against the paper. If you put a cloth ribbon between print element and paper, you wind up with a fair imitation of the Selectric standard. If

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you use a carbon ribbon, you get a significant increase in crispness and quality. The golf ball and carbon ribbon together are what define the standard.

Printers that use the above described approach to putting marks on paper fall into three basic categories: daisywheel printers, thimble printers, and typewriters acting as printers.

Of these three, the daisywheel printers are probably the best known. The print

element in this case is the daisywheel, a flat, circular device with spokes radiating out from the center much like the petals on the flower for which it's named. Each spoke, or petal, normally has a single, fully formed character on it—a letter, number, punctuation sign, or other symbol. In the center of the wheel is a hub, which mounts on the printhead.

When printing, the daisywheel printer rotates the wheel to the proper character.

THE WHEEL THING



Photograph: Les Morsillo

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CIRCLE 471 ON READER SERVICE CARD

A hammer then bangs the character against ribbon and paper. Not surprisingly, the result is nearly identical to the Selectric standard.

Thimbles are best understood as a variation on daisywheels. Picture a daisywheel print element lying on a desk so that the character set is facing down. Now measure the halfway point on each petal and bend the petal 90 degrees at that point so it is headed straight up, with the character on each petal facing away from the hub. The device you wind up with will be (more or less) a thimble. Here, too, the printer produces output by rotating the thimble to the proper character, then banging that character against ribbon and paper.

The last category—typewriters acting as printers—is hardly worth noting except to say avoid it if you can. Typewriters are simply not designed for the constant heavy-duty use that a printer gets. When the cheapest daisywheel printers were \$1,500, this alternative was worth considering. But this is no longer so. One daisywheel printer we tested cost as little as \$399 *list* and was impressive enough to make our list of best buys.

In practical terms, the major difference between a thimble printer and a daisywheel printer is that, in most cases, a thimble print element is easier to put in a machine. A daisywheel element is mounted so it is vertical to the floor. A thimble element is mounted with the hub face down, so that only the spokes are vertical to the floor.

This design means that putting a thimble element in a machine usually requires little more than dropping it in. A few daisywheel printers are designed to let you change print elements just as easily, but most force you to remove the ribbon and disengage the printhead before you can mount the print wheel. If you plan to change type styles often—to print isolated words in italics for example—you should keep this difference in mind.

One of the real advantages of either a daisywheel or a thimble printer is that you

can change typefaces simply by changing the element. You should be aware, however, that different printers use different elements, some of which are interchangeable, but most of which are not. The Diablo 630, for example, uses a differently shaped daisywheel than the Diablo 36.

Some printers can be set to use more than one printwheel type. The Diablo 630 can use any of several daisywheels including an 88-spoke metal printwheel and a 96-spoke plastic printwheel. The 96-spoke plastic wheel is interchangeable with that for the Qume 96. But Qume printers can-

The major difference between a thimble printer and a daisywheel printer is that a thimble print element is easier to put in a machine.

not use the Diablo metal wheels, and Diablo printers cannot use certain Qume printwheels with the Qume proportional space sequence. All of which means that when picking a daisywheel or thimble printer, you should check out the availability of type styles for that printer.

Aside from differences arising from the shape of the printing element, most daisywheel printers and thimble printers are largely equivalent and work the same way. A big, heavy motor has to drag the print element over to the right spot on the paper, a second motor has to rotate the print element to the right character, and an electromagnetically controlled hammer has to slam the proper spoke of the print element against ribbon and paper.

This system means daisywheel and thimble printers are slow when compared to dot matrix printers in the same price range—or are expensive when compared to dot matrix printers in the same speed range. The large rotations of the print element take much more time than simply sticking out a few pins from a dot matrix printhead. And, of course, the print element has to be coordinated precisely with the movement of the hammer.

The mechanics of the daisywheel and thimble printers also explain why they tend to be noisy. Not only is the hammer striking the print element with each character, but in most cases the printhead comes to a sudden stop with each character, then lurches forward again to the next. Each stop and start shakes the printer and generates more noise.

On very slow printers—those that run at under 15 characters per second—the effect is much the same as listening to a fast typist. This sound is not annoying; I find it preferable to the dentist-drill sound produced by most dot matrix impact printers. As the speed picks up, though, so does the noise. The effect on the nerves becomes similar to that of listening to a machine gun. With few exceptions, I love what these printers can do, but I don't want to be in the same room when they do it.

Daisywheel and thimble printers are also limited in some ways, particularly in their graphics capabilities, which range from slim to nonexistent. Some machines permit limited low-resolution graphics, usually produced with periods placed very close together. Not only does this system result in poor quality graphics, but the process takes a heavy toll on the printer. What's more, on most printers that have this capability, the graphics aren't even PC-compatible.

On the other hand, graphics aren't what daisywheel and thimble printers are meant for. They produce Selectric-quality text and do it very well. If Selectric quality is what you want, don't settle for anything less. ■

Teletex TTX-1014

Some printers offer more features than you can handle and charge you for them; others offer too few features and charge you as much as the first group. Somewhere between these extremes is the printer with a price in proportion to its features. The Teletex TTX-1014 is one of these; it may turn out to be the honest,

no-frills champ of printers.

Compared to other daisywheels, it is not full-featured. Then again, it is not expensive, and for \$499 you get an easy-to-use, hard-working peripheral that will probably satisfy most of your correspondence needs.

The TTX is one of the few printers that takes about 5 minutes to set up. This includes installing the ribbon cartridge and the printwheel, connecting the cables, and throwing the power switch. All the proce-

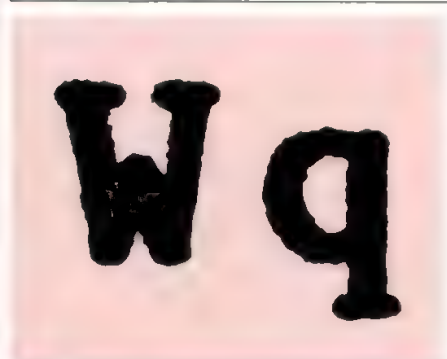
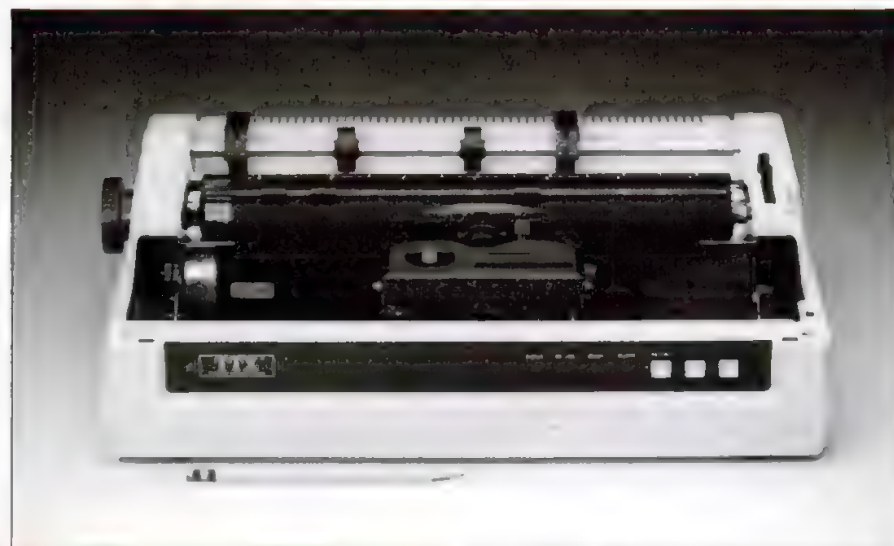
dures are clearly documented and illustrated in the manual. The printer is compact (18¼ inches by 12¼ inches) and light (17.2 pounds), so it can be easily moved from one work station to another.

If you decide to purchase the TTX because it is easy to transport, you should be aware that the printer vibrates quite a bit. A wobbly typing table may not be the wisest choice to support it. On the positive side, the printer is quieter than many of the dot matrix printers tested. In fact, it was one of the few printers that actually was close to the manufacturer-rated decibel noise level.

Although the TTX-1014 does not sport a lot of features, those it does have are quite impressive in their execution and appearance. The standard, default typeface is quite attractive, and the shadow and bold print modes are crisp and clean. Subscript and superscript features are not directly available but can be generated using half-line feeds. The TTX can also underline text and change line height. A good selection of printwheels is available. When installing them, though, be careful, because the thin plastic is easily torn.

All in all, the TTX-1014 seems to be a good daisywheel printer for someone who does not wish to spend a lot of money, or needs a model that can be transported.

—Vincent Puglia



TTX-1014

Teletex Communications Corp.
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List Price: \$499

CIRCLE 725 ON READER SERVICE CARD

using the Power On Default feature(s).

using the shadow print feature(s).

Qume LetterPro 20

LetterPro 20, the little brother of the Qume printer family, has most of the weaknesses of more-expensive products in the line. Heading this list is noise. This printer sounds like a muffled version of the St. Valentine's Day massacre. Not necessarily unpleasant, mind you, but definitely urgent. Along with the noise comes print quality that is indifferent at best.

As befits its stepchild status, LetterPro 20 is simply constructed and easy to operate. It comes with the standard platen knobs, paper-release lever and paper-bail

lever and includes a character scale on the transparent window in the front cover. The LetterPro 20 has front-panel indicators labeled Ready, Attend, and Pause, and switches control pause, form feed, and bidirectional paper feed. A three-position switch under the hood controls print intensity.

The LetterPro 20 comes with a black carbon-film ribbon (called the Qume Multistrike II) and a 12-pitch wheel. Qume sells more than 100 different printwheels for the LetterPro 20, including WP Courier 10, WP Prestige Elite 12, WP Orator 90% 10, WP Letter Gothic 12, and WP Pica 10.

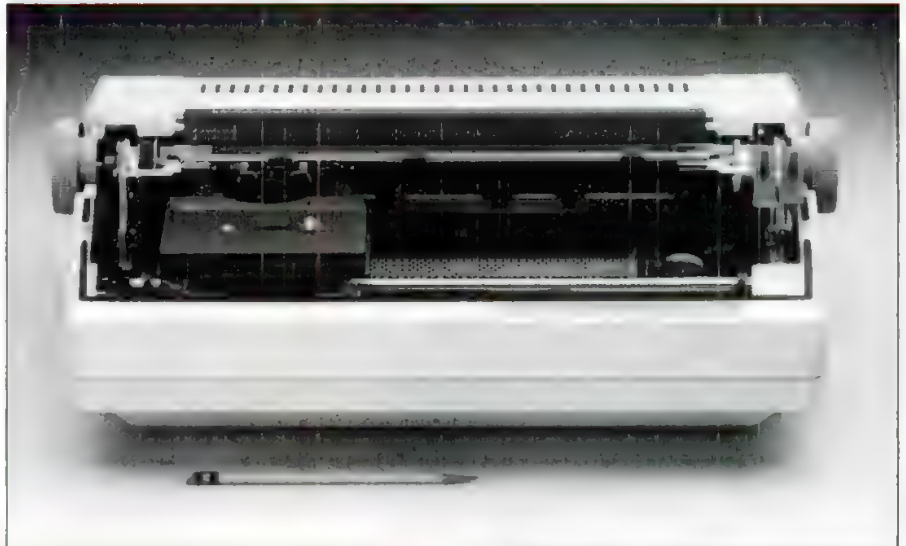
The daisywheel is pressed—not snapped—into place. Consequently there's no way to know if you've done it correctly until the printing begins. The first time I tried, it didn't seat fully. The wheel wobbled and jabbed at the ribbon, which eventually slipped over and behind it. Suddenly the printer wasn't printing. Once I pressed the wheel harder into place, though, the problem went away.

One pleasant surprise is the gigantic manual: It features over 100 glossy pages replete with photographs, diagrams, and more technical charts than you may ever need. Although I caught a few typos in the text, this is a virtuoso performance by printer-manual standards. The most distressing gap between the documentation and reality was the reference to ten DIP switches when in fact there are only eight on the model we received. The factory settings seemed to work.

Some of the documentation is annoyingly imprecise. I had to experiment with several of the features when the documentation vehemently disagreed with itself.

The manual appears to have been printed on the LetterPro 20 itself, and it well illustrates the most distressing defect of this printer—the tops and bottoms of characters tend to fade out. Although superior to dot matrix print, I would rate the LetterPro 20's print quality as barely acceptable.

The LetterPro 20 is a reasonable work-



LetterPro 20

Qume

2350 Qume Drive

San Jose, CA 95131

(408) 942-4000

List Price: \$795

CIRCLE 777 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Bold 2 (Double Strike) feature(s).

horse for letters to Aunt Beatrice and program listings you'll never read. I doubt that businesses will want it for correspondence, though.—**Dean Hannotte**

Comrex CR-IIe

Sometimes I think that if I could just get my hands on a machine to stamp out nameplates, I could come out with my own line of printers. You see, the Comrex CR-IIe is clearly more than a kissing

cousin to the Brother line of printers.

The family resemblance first becomes apparent in the poorly organized documentation. I cannot understand why anyone would not sequentially list the enable and disable codes for accessing special features. But, in true family tradition, the CR-IIe's manual often lists cancel codes well above or below the call ups. Print enhancements are interspersed among various line feeds that go every which way except sideways. If Comrex was going to clone a Brother printer, it at least could

**CR-III**

Comrex International, Inc.
3701 Skypark Drive, Suite 120
Torrance, CA 90505
(213) 373-0280

List Price: \$599

CIRCLE 728 ON READER SERVICE CARD

using the Power On Default feature(s).

have attempted to improve the manual.

The Comrex printer has also borrowed the Brother's COPY feature, which is accessible from the front panel. Of course, how often would you want your printer to make duplicate copies? I think this feature could be handy for office chores, such as creating interoffice memos that are more personalized than photocopies, or for producing limited personalized form letters. Once the document is stored in the printer's 5K buffer, your computer can go on to new projects.

Several print enhancements are available on the CR-III; I liked shadow print best. Although the horizontal spacing between strikes is not sufficient to produce what I'd call a true shadow effect, the end result comes closer to what I would expect of boldface than does a plain double strike.

Unfortunately, the CR-III has also inherited slow carriage action from its Brother forebears. It makes no difference whether there is a full line of copy to print or a totally blank line. The printhead trav-

els all the way to the right and all the way back at the same leisurely pace as it does when printing, which wastes an awful lot of time.

However, if you're shopping for a daisywheel printer, and the confusing manual and the thought of watching the printhead wander aimlessly back and forth don't deter you, then you might want to check out the CR-III. — **Jim Forney**

Sanyo PR-5000

The best way to understand the Sanyo PR-5000 is to strip it down to the Silver-Reed product that lies beneath the Sanyo label. To its credit, Sanyo is quick to acknowledge the lineage of this printer. Unfortunately, the younger generation doesn't quite live up to its parentage.

On the plus side, the PR-5000 is easy to set up and operate. It is very light and sleek, more closely resembling a dot matrix printer than a daisywheel. At 18 pounds, this transportable printer can be used anywhere. The biggest knock against its physical design is that the (single) platen knob sits on the left side, making life a bit unwieldy for office workers accustomed to right-hand design.

Access to the printwheel mechanism is acceptable, although you must remove the ribbon (as well as pry up the print mechanism) just to initiate the change process. The wheel itself has a top knob that you must pull open and properly position onto the print mechanism.

Print quality is acceptable, and the PR-5000's tested speed of 15.6 cps exceeded the manufacturer's claim of 14 cps. The attractive \$599 price, along with the printer's portability and sleek styling, make it an excellent choice for low-demand applications. Unfortunately, low demand seems to be about it for this machine.

For example, there just aren't enough DIP switches to do anything useful. Although I consider avoidance of DIP-switch switching the sign of a truly computerized civilization, I have also come to

appreciate the correlation between the number and power of DIP switches on a daisywheel printer and the number of features the printer supports. There are five such switches on the PR-5000, and none of them do very much.

The most important switch moves the printer mode from serial to line print and vice versa. Note that "serial" here does not actually change the printer from parallel to serial, rather it alters the way characters are processed within the parallel universe. In serial mode, characters are printed one by one as received. In line mode, characters are momentarily held in a one-line buffer and printed upon receipt of a carriage return. Line mode increases throughput and lets the printer support bi-directional output, while serial mode allows access to and control of many, many more printer features.

The serial mode represents the minimalist ethic behind this printer. None of the serial mode features (underline, bold-face, shadow printing) can be triggered with normal ASCII command sequences. Instead, PR-5000 users must write or otherwise obtain BASIC (or another language) routines to "kludge" a solution to the absent hardware-tied features. Luckily, the otherwise deficient 20-page manual offers a liberal supply of prewritten BASIC routines to drive the printer.

To create an underline, for example, you have to write a BASIC program that prints the desired character, backspaces, and then prints the underline character. Most printers simply turn on the underline character with an ASCII code and then turn it off on request with another ASCII code.

Of course, Sanyo does not expect you to write BASIC programs to achieve standard word processing functions. Rather, it hopes that designers of word processing software will include the codes for you. I don't know how likely it is that many word processing companies will do that, so you may have to write the codes yourself or operate this printer without the use of these enhancements.

Sanyo's approach seems to have been to supply the fewest features for the least amount of money. The Silver-Reed printer that the PR-5000 is based on includes ROM chips to enable many word processing programs to tie directly into a standard ASCII code process. In effect, it supplies the code that Sanyo asks you (or the software company) to write. That being the case, it seems to make sense to pass over the Sanyo printer in favor of the Silver-Reed version that comes with built-in features.—Russell Lipton

Electric Typing Fingers

Personal Micro Computers has invented what is easily the drollest entry in *PC Magazine's* printer sweepstakes—a machine that sits on top of a Selectric keyboard and types 80 words a minute.

PMC sees Electric Typing Fingers primarily as a clever device for turning office typewriters into on-line printers—and that



using the Power On Default feature(s).



PR-5000

Sanyo Business Systems Corp.
51 Joseph St.
Moonachie, NJ 07074
(201) 440-9300
List Price: \$599

CIRCLE 749 ON READER SERVICE CARD

it does. Electric Typing Fingers works exactly as described, happily punching away at your typewriter keyboard with "push studs."

I tested Fingers on a Selectric-compatible Silver Reed 225C. Setting it up takes a lot of adjusting, but it took me only about 20 minutes. You hook two "attachment feet" into the gap below the Shift keys and then adjust the screws until the plungers (the push studs) almost touch the keytops they need to strike. It's very hard actually to see what's going on, though, and a

transparent housing would have been a great help.

You power up the computer and write a three-line BASIC program that types out the alphabet; then you probably go through several more rounds of adjusting. If a few of the key plungers still don't register properly, you can elongate them with rubber caps. Finally, when everything works, you immobilize the attachment feet with adhesive tape.

Fingers strikes one keytop for every alphanumeric or special character it

receives from the computer. Since it strikes only one key at a time, it handles an uppercase character by punching the Shift Lock key before and the Shift key after.

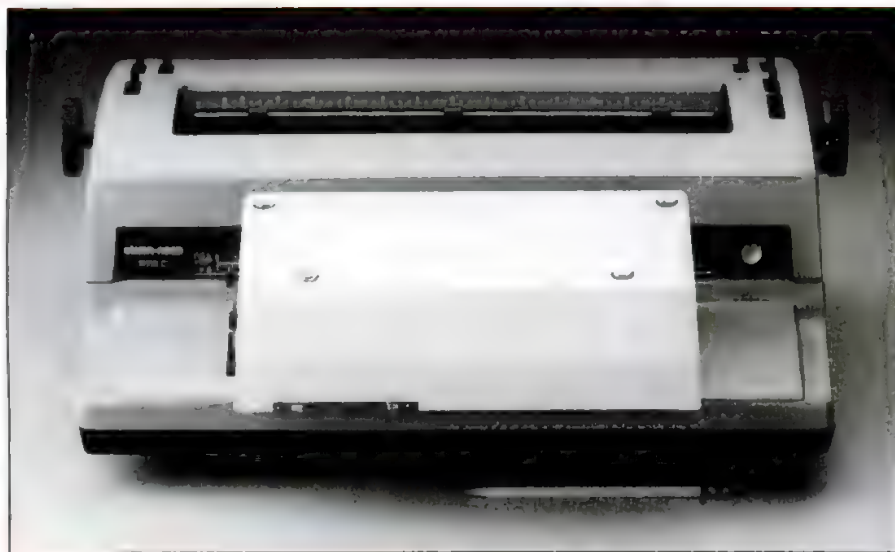
Anything other than an alphanumeric or special character is ignored except for the carriage return and backspace key, with which you can overprint anything on the current line. Not every word processor will be happy about implementing such features as underline and double strike "manually," however.

Apart from the typewriter's Shift and backspace keys, Fingers touches no other controls. You can't tab, for example, or toggle the typewriter on and off. The device does have a few, very handy switches of its own, however. There is a pause switch so you can answer the phone in peace, and you can toggle the speed from 12 cps to 10.

Since Fingers has no buffer, it can't look ahead to see what's left on the current line. So if you hit `PrtSc` to print out a screen that has nothing but prompts on it, Fingers will still hammer the space bar 1,950 times! And though Fingers isn't noisy in itself, you'll have to endure the clatter of your typewriter.

Fingers has some unexpected uses. For one thing, it's a boon to blind and visually impaired people. Attaching it to an IBM Braille typewriter and hitting `Ctrl-PrtSc` will turn the typewriter into what is effectively a Braille printer.

Electric Typing Fingers is a nice machine if you insist on keeping your Selectric to double as a printer. Considering the new breed of daisywheels that cost about the same as Fingers, though, I wonder why you'd bother.—Dean Hannotte



Electric Typing Fingers
Personal Micro Computers, Inc.
275 Santa Ana Ct.
Sunnyvale, CA 94086
(408) 737-8444
List Price: \$395

CIRCLE 694 ON READER SERVICE CARD

Wq

using Power On Default

Daisy M-20

What is low, wide, handsome, and not so hot? Try the new M-20 daisy-wheel printer from Daisy Systems.

Once you've wrestled its enormous carton to your desk and pried it open, what comes out is a classic case of beauty and

the beast. The M-20 is wide enough to cover half the desktop and has a sleek polished appearance that belies the slug living inside. It has some nice features but is a poor performer in terms of both print quality and speed.

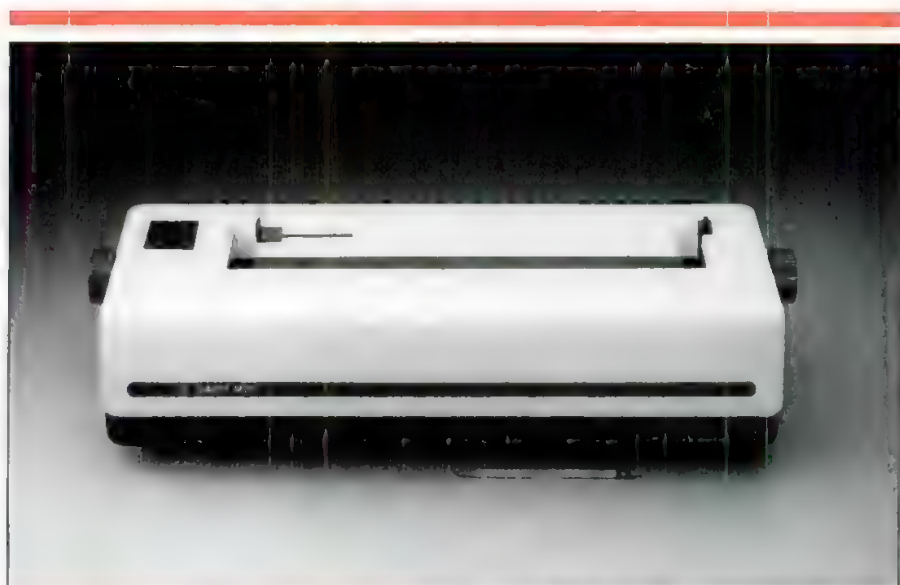
Many computer users tend to "plug it in and go" first and check the manual later. Try that with this printer and you'll break it, since the printhead is secured by an almost invisible nylon tie-wrap that must be cut before powering up the printer. Unlike many printers, the M-20 does not carry any note or warning sticker on the machine admonishing you to be careful. There is a note in the manual, but it is several pages from the front and could easily be missed by a speed reader.

The extreme width of the M-20 is due to a carriage capable of taking 16.5-inch paper (and printing on 15.7 inches of it). This could be a real advantage to professionals (architects, for example) who need to print text on wide documents. Unfortunately, if you don't need to do this, you still have to give up a huge amount of desk space to this machine.

The M-20 has a full-width drop front, which exposes the printer works for easy access to printwheel, ribbon cartridge, the platen area, three sets of DIP switches, and a rotary setup switch for forms length. For such a simple printer, the number of switch settings is almost bewildering, but you can reach everything from the front once you swing that wide panel open.

The manual gets a 2 on a scale of 1 to 10 and reminds me of the ones that came with Japanese tape recorders 10 years ago. If you can't follow the instructions and decide to ask for help, you'll be frustrated to discover that the manufacturer's name, address, and phone number do not appear anywhere on the manual. Good luck!

The M-20 uses a nonstandard printwheel that costs \$21 to replace and nonstandard ribbon cartridges that run \$7 each, in black only. If you can find its address, you buy them direct from Daisy. Bell & Howell handles service (\$243 on-site, \$162 depot). Daisy has a support



M-20

Daisy Systems Holland B.V.
4646 Bell Dr.
Chamblee, GA 30341
(800) 423-2479
(404) 451-0257

List Price: \$999

CIRCLE 702 ON READER SERVICE CARD

using the Power On Default feature(s).

using the BOLDFACE feature(s).

using the SHADOW feature(s).

using the BOLD/SHADOW feature(s).

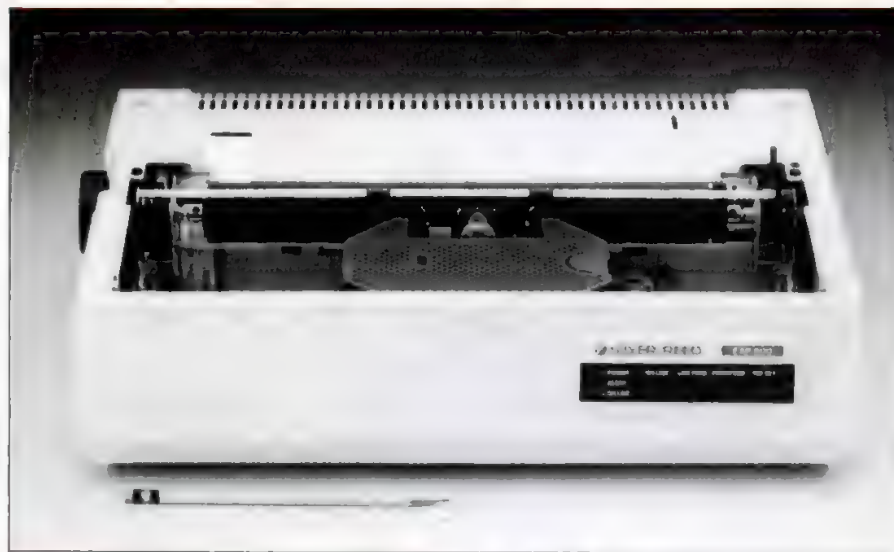
office in Georgia, but not many others.

Print quality is poor: descenders are blurred or missing even in enhanced modes. Proportional spacing runs letters together so that adjacent characters touch. With the throttle wide open, I got 22 cps on the speed test, but this figure drops to 9 cps with boldface or shadow enhancement.

At \$999, the M-20 is not a good buy. There is no excuse for such low speed and poor print quality, and its use of nonstandard printwheels and ribbons seals its fate.—John Phillips

Silver-Reed EXP-500

This printer reminds me of American automobiles from a few years back. Remember in-dash trip computers and push-button automatic transmissions? The manufacturers took sound technology and added a few technological gimmicks—which were usually the first things to break down. The Silver-Reed EXP-500 is the



EXP-500
Silver-Reed America, Inc.
19600 S. Vermont Ave.
Torrance, CA 90502
(213) 516-7008
List Price: \$549

CIRCLE 783 ON READER SERVICE CARD

using the Power On Default feature(s).

printer world's answer to those cars.

For example, opening the cover causes the machine to automatically move the print head to the center of the platen. That makes it easier to change the ribbon or print wheel, but closing the cover returns the head to the left-hand margin, so don't try this during a print operation. The limited graphics mode allows you to print some rudimentary point plots, but the quality of these charts is inferior to cheaper dot matrix printers. It's not that a printer shouldn't have these features; it's just that

I think the money Silver-Reed spends on them would be better used to improve other aspects of the product.

Although the EXP-500's actual speed, about 15 cps, was about the same as the manufacturer's specifications, it prints no faster than its little brother, the EXP-400 (which costs \$150 less). In addition, the tractor feed attachment's close proximity to the printer's case made loading paper extremely difficult. And, although the EXP-500 includes a buffer, it's just 80 characters—one line—so don't throw out

Although the EXP-500 includes a buffer, it's just 80 characters—one line—so don't throw out your printer spooler program yet.

your printer spooler program yet.

On the positive side, the EXP-500 may be the cheapest printer to achieve escape sequence compatibility with the Diablo 1610, which should make it attractive to users of word processing programs designed to work with that printer. The hardware includes horizontal and vertical tab settings that facilitate work with specialized forms, and the multitude of print wheels invites international usage. Like those of the EXP-400, its ribbons are interchangeable with Olivetti ET series ribbons.

So, if you want a printer with a few extra bells and whistles—and are willing to pay \$150 extra for them—this is the machine for you. If not, stick to the EXP-400.—**Bill Harts**

C. Itoh A10-20R

If your printing priorities put print quality and cost ahead of speed, then you should investigate the C. Itoh A10-20R. It's hard to believe that this printer delivers the same daisywheel print quality as its big brothers, the F10-40 and F10-55, which cost twice as much. And it's even harder to believe that it offers the same features plus one more—a standard print buffer that's optional on the higher-priced mod-

els. The catch is the A10-20R's 18-cps default printing speed.

Both pica and elite pitches are available, and the boldface, shadow print, proportional spacing, and underlining features may be combined for true letter-quality printing. Foreign-language character wheels are also available. Inserting and changing print wheels and ribbon cartridges (compatible with Diablo Hi Type II) is a simple, no-mess procedure.

Unfortunately, loading the paper into our test model caused an hour or so of frustration. No matter how often I readjusted things, the standard friction-feed roller did not advance the paper, and the print came out superimposed on one line.

I called a C. Itoh technical representa-

Without the optional tractor-drive assembly, the paper tended to slip to one side, taking the margin with it. Fixing the problem was easy, though.

tive, but he could only say that it shouldn't be doing that. The ill-conceived manual was no help either. Luckily, one of PC's technical editors finally noticed that the roller was installed backwards so its gear was on the wrong end, and installing correctly fixed the problem.

I also had some minor problems keeping the paper aligned and felt a strong need for the optional tractor-drive assembly. Without it, the paper tended to slip to one side, taking the margin with it. It was easy



using the Power On Default feature(s).



A10-20R

C. Itoh Digital Products

1011 Francisco St.

Torrance, CA 90502

(800) 348-1984, (213) 327-5939

List Price: \$795

CIRCLE 750 ON READER SERVICE CARD

enough to fix the problem each time it occurred (which was not too often), but who wants to operate a machine with his fingers crossed?

The wide-carriage body is not quite as large as those on the F10-40 and F10-55, nor is it quite as stylish. The front panel sports three lights (power, on/off-line status, and error alert) and three buttons (on/off-line, line/form feed, and pitch). Using the pitch button, pica, elite, and proportional spacing may all be selected conveniently from the front. Another handy fea-

ture is a small panel at the top rear of the cabinet that slides out to reveal the DIP switches, enabling one to concentrate on the soul, not the guts, of the machine.

For letters and short documents, the A10-20R gives you letter quality print at a price you'll find hard to beat. But even the default printing speed isn't fast enough for data processing or any lengthy print runs. And once you invoke two or more print enhancement features, it's like watching a turtle do the 100-yard dash.

—Phil Wiswell

Amdek 5025

The Amdek 5025 daisywheel printer, made by Ricoh, has both a stylish, low-profile, wide-carriage appearance and a list price of under \$1,000. Initial setup is straightforward and easy. After you've removed the usual shipping restraints, it's mostly a matter of installing the daisy-wheel and the ribbon cartridges. Unlike most printers, the Amdek 5025 comes

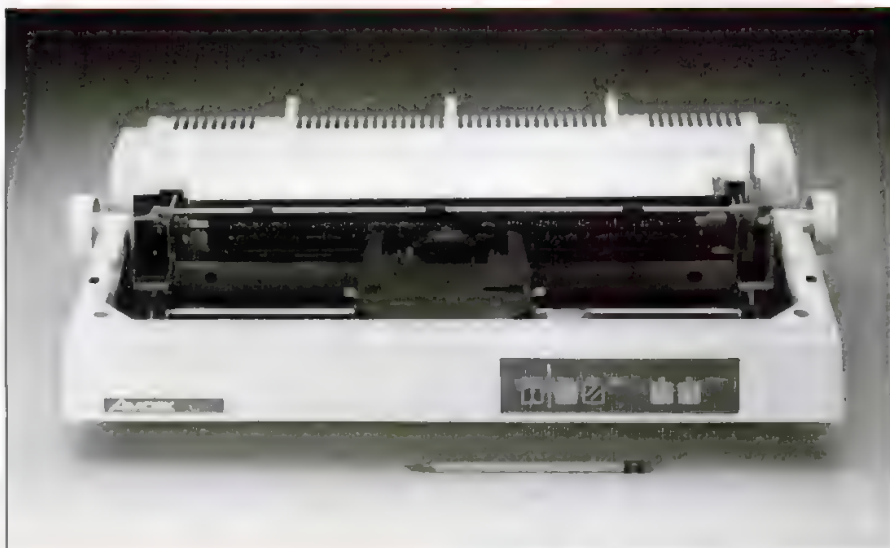
complete with its own interface cable.

The machine that I tested went on-line and was ready for work less than 10 minutes after I started unpacking it. In fact, I hardly referred to the manual until it was time to check the escape codes for trying features, but the documentation provided with the printer appears adequate to enable a less-experienced user to get the printer operating.

Print quality is fairly good, though not spectacular, and the Amdek machine has practically all the features expected of ful-

ly formed character printers. Its boldface print mode is not particularly bold, however, and its shadow mode, though not really shadow, produces a better bold enhancement than boldface does.

I was most unhappy with the painfully slow paper-feed mechanism. A form feed for an 11-inch form takes 8 seconds, and that's just too long. For its size, the 5025 seems light in weight, which is nice if you have to move it around very much. How-



Wq



5025

Amdek Corp.
2201 Lively Blvd.
Elk Grove Village, IL 60007
(312) 364-1180
List Price: \$799

CIRCLE 715 ON READER SERVICE CARD

using the Power On Default feature(s).
using the bold face feature(s).

Juki furnishes an extremely readable manual. Some sections are so well done, they could serve as guides for any printer.

ever, I like to see a little more heft in a machine destined for office use—it gives me more confidence in the machine's long-term durability.

On the whole, I couldn't find a great deal to criticize about the Amdek 5025. But then again, I couldn't find very much to praise extravagantly either. It seems to be just another run-of-the-mill, inexpensive daisywheel printer.—**Jim Forney**

Juki 6100

The Juki 6100 is an intriguing little daisywheel printer. Of course, intrigue doesn't print your letters or send out your reports, but the 6100 is making quite a lot of noise in the printer market—because of both its \$599 price and the wealth of features you get for that price. Unfortunately, it also makes a lot of noise of the more

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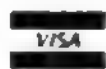
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CIRCLE 346 ON READER SERVICE CARD

normal variety. A testimony to its value, however, is that it just might be worth purchasing anyway.

The Juki 6100 is easy to set up and use. It has control-panel switches for standard or proportional spacing, it uses Selectric II ribbons, and it employs Triumph-Adler drop-in-style printwheels. Another nice touch is a guide on the sound cover that shows the different spacings for 10-, 12-, and 15-pitch printwheels. The Juki comes with a standard 2K buffer, and you can enhance that to 8K.

My only physical criticisms of the Juki concern its somewhat odd 13-inch platen size, its substantial heft (over 30 pounds), and, of course, its offensive, whining, whirring screech that makes otherwise normal people shift uneasily on their feet and look for the nearest exit.

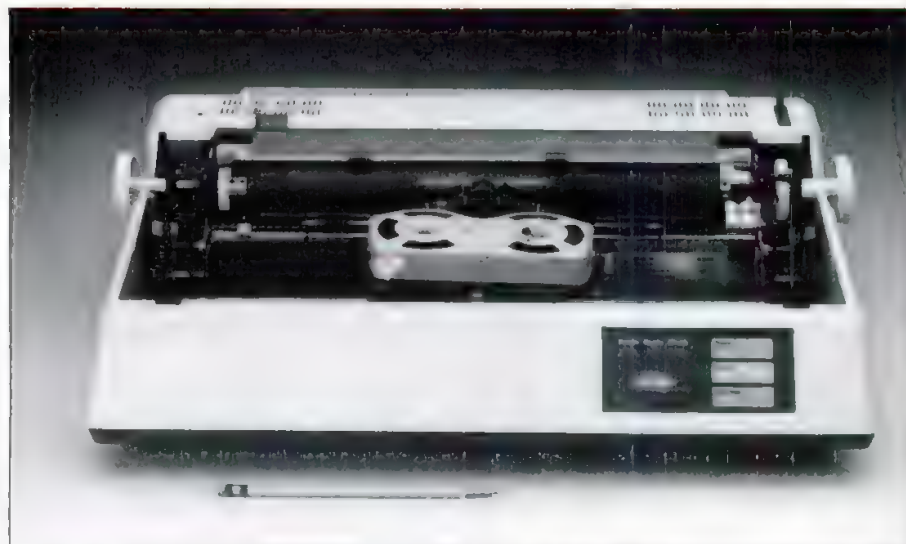
All that aside, the Juki 6100's functionality stacks up quite well against many printers costing twice as much. I found it, for example, to be surprisingly fast during our real-world speed test (more than 20 cps). I easily sent it the requisite ASCII codes for shadow printing, underlining, proportional spacing, and other desirable special features. Overall print quality was more than adequate.

Best of all, Juki furnishes an extremely thorough and readable manual. Some of its sections (the ASCII codes, for example) are so well done that they could almost stand alone as informational guides for any printer.

The manual covers everything from unpacking the printer to technical specifications for interfaces. It describes WordStar installation so that users of that program can quickly take advantage of the Juki's features.

Do the Juki 6100's good points outweigh its noise problem? Try it out for yourself. If you can live with the whining sound, you should consider buying. If you can't, I can only suggest you wave a sad goodbye and wait for the manufacturer to redress the single flaw that drastically undercuts the value of an otherwise fine machine.—Russell Lipton

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Wq

using the Power On Default feature(s).
using the shadow print feature(s).



Juki 6100
Juki Industries of America
299 Market St.
Saddle Brook, NJ 07662
(201) 368-3666
List Price: \$599

CIRCLE 769 ON READER SERVICE CARD

Sanyo PR-5500

The Sanyo PR-5500 looks and feels different than its junior sibling, the PR-5000. It's much heavier (30 pounds compared to 19), has a fuller complement of control-panel switches, and costs significantly more.

Nonetheless, it is hard to understand why someone would prefer the 5500 to the 5000. The 5500 feels more solid, but it

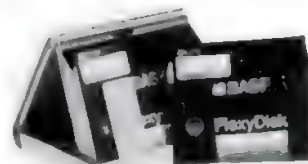
sacrifices the transportability of the 5000. And there is scarcely any difference in speed between the two machines.

Some problems are common to both machines. Sanyo's minimalist approach to printer design will frustrate novice users because their favorite programs are not fully supported, and it will frustrate experienced users because they can't get the printers to sing.

At least the PR-5500 is easy to set up and run. The manual, although lacking in many areas, illustrates setup procedures

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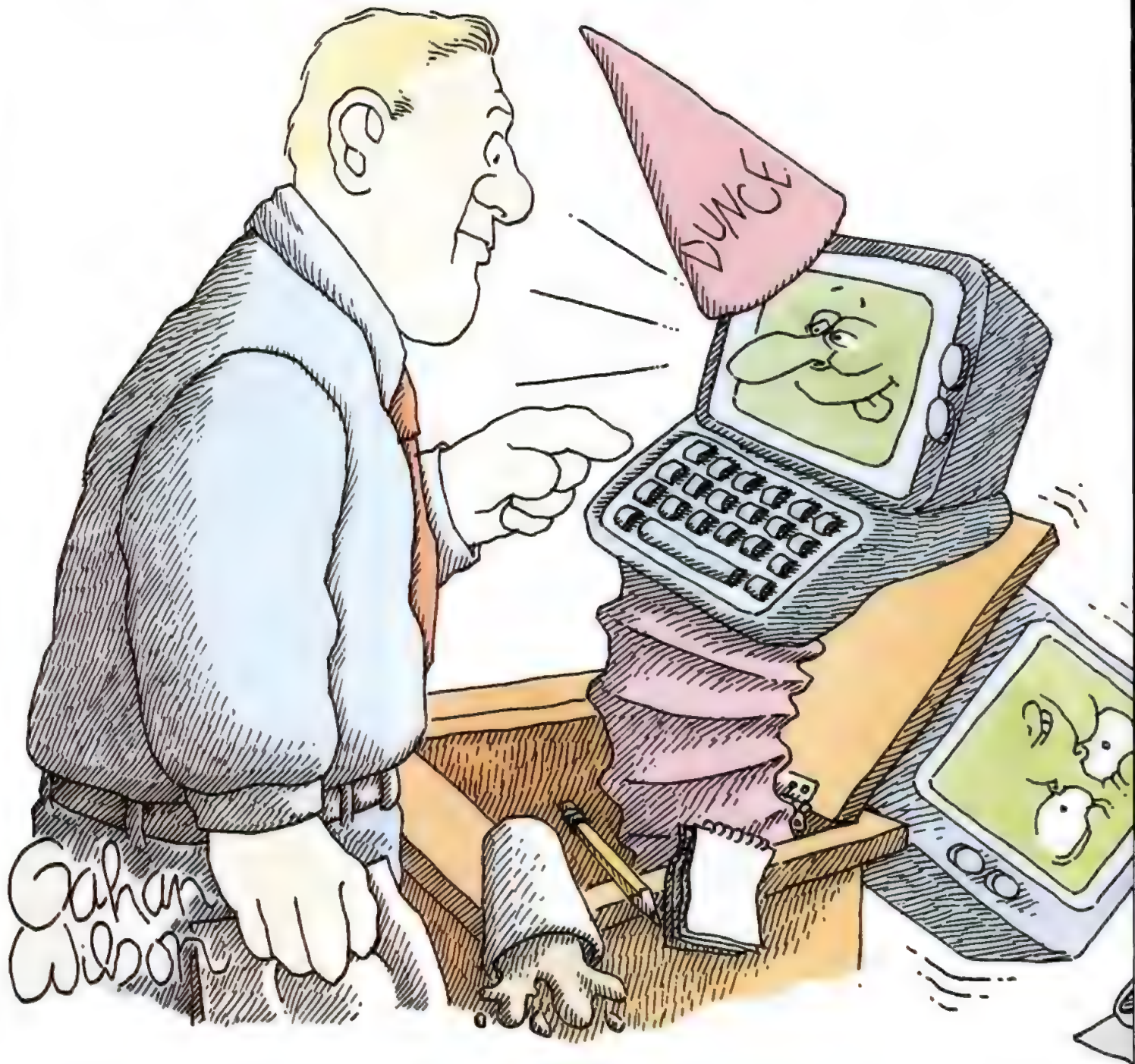
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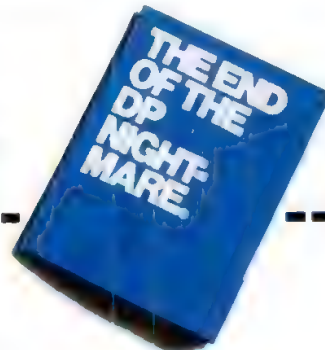
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NIGHTMARE.

(including printwheel insertion and ribbon installation) with an effective combination of clear pictures and text. Other printer manufacturers would do well to follow suit on this score.

Unfortunately, the manual stops being helpful and descends into the arcane world of control codes as soon as you get the printer operational. The deserted user is left to figure out how to move from the control codes to a series of events that might make something actually happen. The section on codes is followed by timing

charts and input and output circuit diagrams as well as information on the signal interface. The 20 pages of manual are for the most part unusable for average businesspeople.

It's important to remember that the PR-5500 is actually a Silver-Reed machine disguised with a Sanyo label. Service people at Sanyo were careful to remind me that these were Silver-Reed printers, almost as though they didn't want to be held accountable for them. (To their credit, the Sanyo people were forthcoming and

professional in answering all of my questions.)

The PR-5500 points up the difficulties that can arise when manufacturers tumble into bed with the products of other companies. There is nothing wrong with Silver-Reed printers. In fact, their ease of setup and operation are strong selling points. But Sanyo has not gone to the trouble of adding its own value and support to the machines. Sanyo may now have a printer to sell, but it doesn't yet have a printer worth buying.—Russell Lipton



using Power On Default



PR-5500

Sanyo Business Systems Corp.
51 Joseph St.
Moonachie, NJ 07074
(201) 440-9300

List Price: \$995

CIRCLE 752 ON READER SERVICE CARD

Brother HR-25

If I had to spend my next life as a medium-priced daisywheel printer, I think I'd like to be a Brother HR-25 and settle down in a nice, comfortable office somewhere.

My first look at the HR-25 told me that this printer was going to be fun. Basically it's not that different from other daisywheel machines, and it isn't especially fast. But then it's not very expensive either. It will do just about anything you expect a daisywheel printer to do, and it has some nice features that give it just a little edge over its run-of-the-mill competition.

One of the little extras on the HR-25 is the capacity to respond directly to your computer keyboard—effectively doubling as an electric typewriter. I know from my own experience that this feature could save a lot of scribbled envelopes and memos. It's perfect for those jobs that can't justify dragging out a typewriter, but are difficult to do on a typical computer printer.

Another extra that could come in handy in many offices is the COPY function. The HR-25 can turn out copy after copy of the same document once it's stored in the printer's buffer, thus freeing the computer for new chores. This feature could help turn out high-quality, personalized form letters. Just type in each new name and address and use the copy-button sequence

to print out the text from the buffer. It can't compete with a good mail merge program, but, for quick little mailings, it could probably have the job done before you could get a fancy program started.

The Copy button is just one of several buttons and indicators on a small panel on the front of the machine. You can use these to set the type size and select such options as line or form feed. However, using control codes from the computer seems to be the most efficient way to control the printer's functions—especially changing type sizes in mid-document.

I was a little disappointed with the Brother HR-25 manual's failure to organize the various command codes in a logical order. I was also disappointed that the printhead travels across the full line whether or not there is anything there to

The HR-25 has the capacity to respond directly to your computer keyboard.

print. This relatively slow trip all the way back and forth, even on totally blank lines, seems a needless waste of time.

The HR-25 may not be perfect, but overall it's a really strong package. Besides, *perfect* doesn't seem to be a word that applies to printers.—Jim Forney

Silver-Reed EXP-400

Until recently, a letter quality printer could run you \$5,000 or more. The low-cost Silver-Reed EXP-400 shows just how far the computer industry has come. According to our tests, the EXP-400's daisywheel mechanism tools along at a smooth 12.9 cps (it's rated at just 10 cps)



HR-25

Brother International Corp.
8 Corporate Place
Piscataway, NJ 08854
(201) 981-0300
List Price: \$895

CIRCLE 727 ON READER SERVICE CARD

using the Power On Default feature(s).

using the boldface feature(s).

while producing print of a quality to rival many of its high-priced competitors. With a list price of \$399, the Silver-Reed EXP-400 may be one of the great bargains in computer hardware.

If you think that this \$399 gets you nothing but a stripped-down, no-frills letter banger, think again—this admirable machine includes such features as incremental spacing, rudimentary graphics (not DOS-compatible), boldfacing, underlining, and subscripting and superscripting. A good number of different print wheels

are available, since the manufacturer wisely made its product compatible with Brother electronic typewriters. Similarly, it can use ribbon cartridges from Olivetti ET series printers, so most supplies can be purchased from an office products dealer rather than a higher-priced computer store.

There are some minor annoyances, however. The front panel has no real top of form switch. If you hold down the line-feed button, the paper feeds continuously, rather than stopping at the top of the next page. The panel's configuration is a bit

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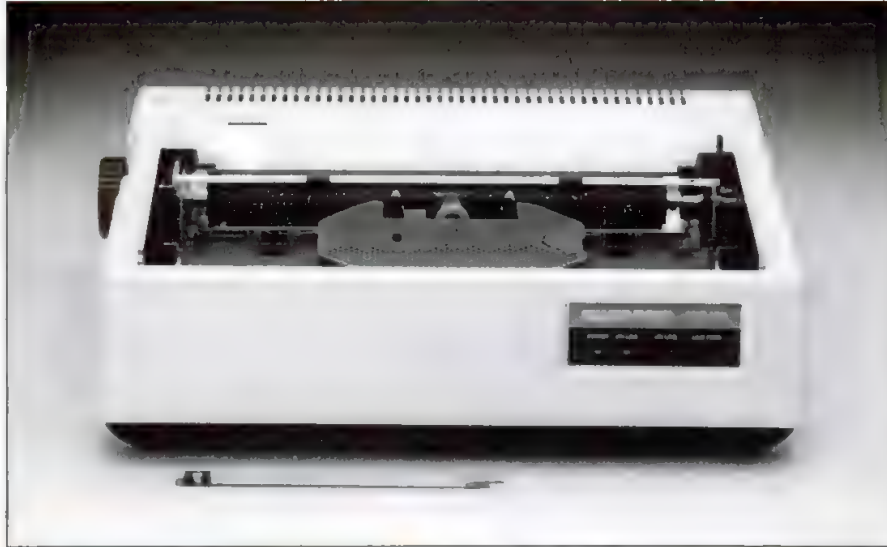
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CIRCLE 171 ON READER SERVICE CARD



Anderson Jacobson 831

The AJ 831 daisywheel printer is actually a reconditioned AJ 832, a decade-old ASCII keyboard terminal that can still be used as such, if you have a need. In fact, the AJ 831 also functions as an electronic typewriter, and it comes on a rolling stand. Unfortunately, I have just run out of nice things to say about the AJ 831.

Aesthetically, the AJ 831 looks sort of like a washing machine, and if you do your computing in the laundry room, it'll fit right in.

The huge unit weighs over 100 pounds with its rolling-wheel base attached. Aesthetically, it looks sort of like a washing machine, and if you do your computing in the laundry room, it'll fit right in.

You need the optional tractor drive unit to get any serious work done on this machine. Single sheets pose no problems, and you insert them exactly as you would load paper into a typewriter. I appreciate this simplicity. Unfortunately, roll or fan-fold paper has a strong tendency to shift, which, over a number of pages, produces very uneven margins.

Pica and elite are the only pitches available, and the AJ 831 doesn't support proportional spacing. You can print subscripts and superscripts using half-line

Wq

EXP-400

Silver-Reed America, Inc.
19600 S. Vermont Ave.
Torrance, CA 90502
(213) 516-7008

List Price: \$399

CIRCLE 800 ON READER SERVICE CARD

using the Power On Default feature(s).

using the boldface feature(s).

awkward. For example, to set bidirectional printing mode, you must hold down the On-line button when you turn on the printer. To set the automatic line-feed after a carriage return, you hold down the Line Feed button when powering up. Like some other ultra-low-cost printers we tested, the unit lacks a bell or beeper. Still, you get what you pay for, and I feel these little failings can be easily overlooked.

The printer uses a Centronics-compatible parallel interface so the port on your monochrome monitor card controls it. The

tractor feed is a must for printing long data processing jobs, because continuous forms tend to jam under the pressure of friction-feed rollers. The EXP-400 accepts paper or forms only up to 9½ inches wide.

Although listed at \$399, a quick check of mail-order equipment dealers in the pages of *PC* should turn up the EXP-400 for under \$300. At that price, you can get into letter quality printing and still have enough left over to think about replacing your old television set, too.—**Bill Harts**

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CIRCLE 148 ON READER SERVICE CARD

PRINTEK 930

the executive's printer



feeds, but you can't underline anything. The AJ 831 won't emphasize the single pass of its printhead except when you invoke "correspondence quality." This 23 cps mode double strikes the letters and darkens them into a reasonable approximation of acceptable print quality.

What more can I say? The AJ 831 is very well built, sturdy as an ox, and will probably still be going strong in another decade. And if you could get one for a hundred bucks or so, I'd encourage you to put it in the closet as a back-up printer. But considering what else is available for \$600, it is hard to justify purchasing the AJ 831.—Phil Wiswell

Star PowerType

The Star PowerType may not be a super-nova in the galaxy of daisywheel printers, but it isn't a dwarf, either. It offers a number of print enhancements, it's easy to use, and it provides help for the novice.

PowerType's enhancements include boldface and shadow print, three type pitches (pica, elite, and condensed), and proportional spacing. The boldface is very crisp, and you can use it as a correspondence quality mode. The character set itself is a well-formed serif font, although the apostrophe resembles an accent sym-

Power Type may not be a super-nova, but it's not a dwarf either. It has a number of enhancements and it's easy to use.

bol. PowerType also permits subscripts and superscripts, underlining, horizontal and vertical tabs, and the printing of daisywheel graphics.

The control panel consists of six lamps and five buttons. One of the buttons enables the user to switch between the printer's normal mode and a separate word processing mode. The only difference between the two is in the escape code sequences; the word processing mode is compatible with *WordStar* programming. One of the lamps thoughtfully signals that

the end of the ribbon has been reached.

The DIP switches, located on a ledge just beneath the cover, are easily accessible. They control the selection of the print-wheel, interface (serial or parallel), mode, and control parameters (software or switches). Alongside the DIP switches are five slide switches used to set form length, specify a line feed with or without carriage return, choose one of three pitches or proportional spacing, select from four different line spacings, and designate the amount of printing pressure appropriate



AJ 831

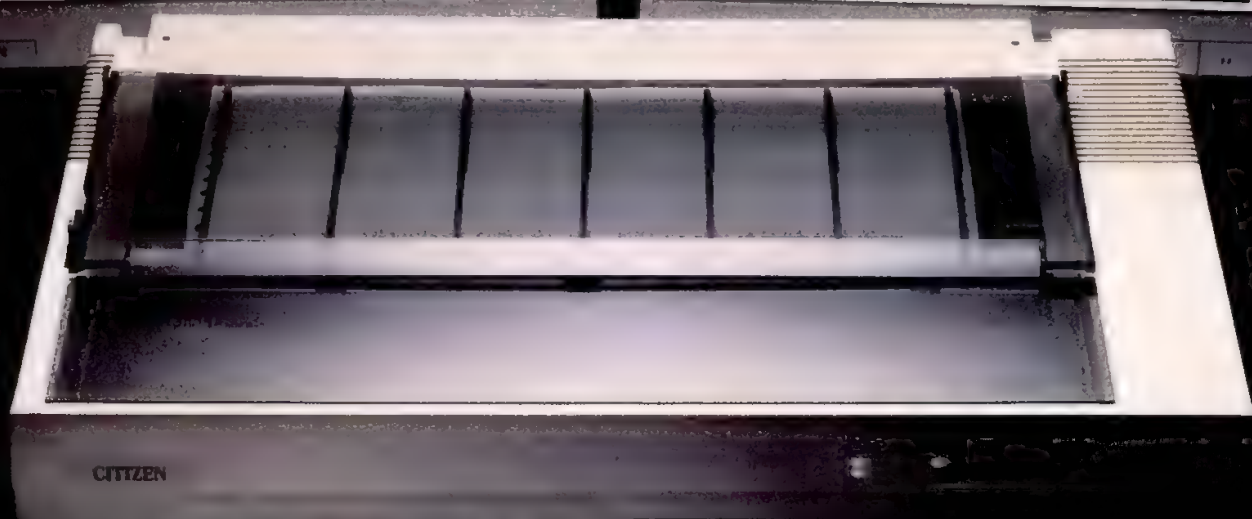
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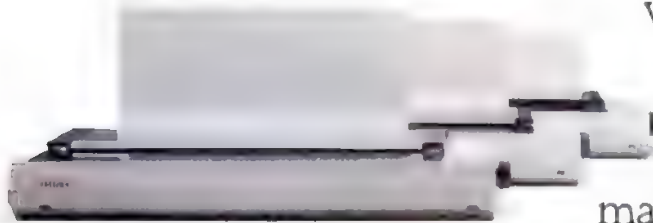
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using the Power On Default feature(s).
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for a given paper thickness.

Although I reviewed a preliminary version of the manual, it was fairly well organized and illustrated. The escape code sequences appeared twice—in the main document and in the appendixes—and each sequence was complemented with descriptions of its purpose and format, as well as other remarks and references.

PowerType's biggest drawback is its lack of a standard tractor feed. Although an optional tractor with paper separator is available for \$59, a pin roller could have

been supplied with the basic unit—fanfold paper just doesn't stay in place on the pressure roller. Aside from that, this Star offering shines rather brightly.

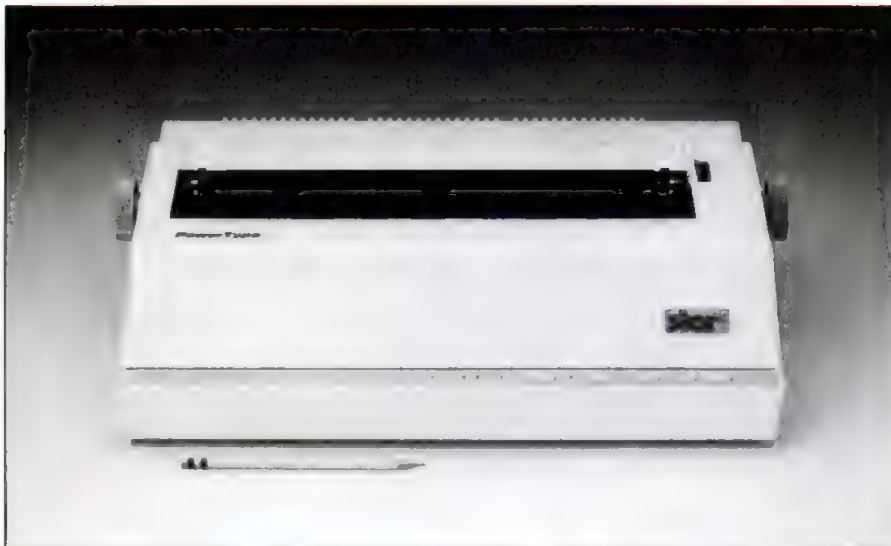
—Vincent Puglia

Dynax DX-15

The Dynax DX-15 is a slow but pretty daisywheel printer. Advertised printer speeds are usually about as reliable as advertised mileage rates for cars, but in the

case of the DX-15, the advertisements are refreshingly honest—the printer is every bit as slow as they promise. Excruciatingly slow in its default mode (13 cps), the Dynax DX-15 was so slow in its shadow print mode (6 cps) that I could actually outpace it on my typewriter.

This sluggish rate doesn't appear to bother the folks at Dynax. As a matter of fact, they offer an optional keyboard (\$150) that transforms your printer into a



using the Power On Default feature(s).

using the bold print feature(s).



PowerType

Star Micronics, Inc.

2803 E. 12th St.

P.O. Box 612186

Dallas/Fort Worth Airport, TX 75261

(214) 456-0052

List Price: \$499

CIRCLE 717 ON READER SERVICE CARD

The DX-15 is a handsome, well-made machine. Its control panel looks more like a photocopier than a printer.

standard typewriter. If you are in no great hurry for your hard copy, and you occasionally like to try your hand at that anachronism the typewriter, take a look at the Dynax DX-15.

The DX-15 is a handsome, well-made machine with a control panel that looks more like the front of a photocopying machine than a printer. It has a copy button for printing multiple documents from the contents of the 3K buffer (expandable to 5K), line-pitch button for automatically specifying the line spacings, and a print-pitch button for selecting settings of 10, 12, or 15 characters per inch, or proportional spacing. Although you can program line pitch and print pitch, I find it very convenient to have them accessible at the touch of a button.

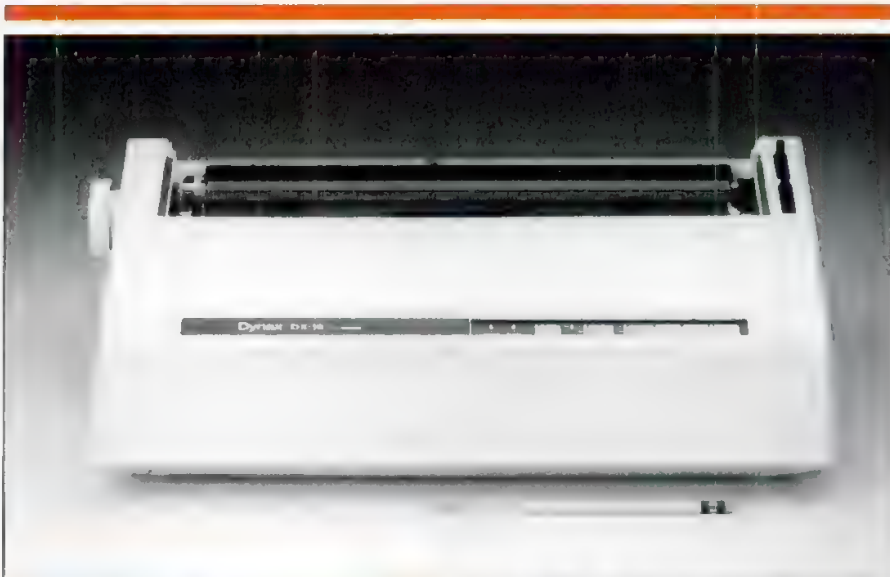
The print quality is superb, and you can easily program the features. The documentation, it's true, is a little quirky in places (it lists escape sequences, for example, as Esc+F, rather than the traditional Esc-F), but for the most part it is adequate. The printer emulates the Diablo 630, and so configuring it to various word processing packages is a straightforward procedure. You can choose from a variety of different ribbons (including colors) and over 20 different daisywheels. Investigate the optional tractor feed (\$120) if you want to print anything longer than short business letters.

If you buy this machine, I'd advise taking up knitting to pass the time as the printer taps out your copy. The \$499 price tag will leave plenty of money left over for yarn. —Robin Raskin

Silver-Reed EXP-550

The slow and steady Silver-Reed EXP-550 resembles the proverbial tortoise: it has what it takes to be a winner in the right kind of a race. This daisywheel printer runs in both line-print and serial mode, but, since the buffered, bidirectional line-print mode is virtually featureless, most of

This low-cost printer includes incremental spacing, rudimentary graphics, boldfacing, and much more.



DX-15

Dynax, Inc.
6070 Rickenbacker Rd.
Los Angeles, CA 90040
(213) 727-1227
List Price: \$499

CIRCLE 714 ON READER SERVICE CARD

using the Power On Default feature(s).
using the shadow print feature(s).
using the shadow, double red feature(s).

your word processing requirements will restrict you to the serial mode. Unfortunately, shadow and bold prints work only in the line-print mode. This simplistic design of the EXP-550 may force users to avoid all of the printer's features rather than twiddle around between the two modes.

At \$649, the machine is cosmetically elegant. Its accompanying manual embodies Goldilocks's dream of "not too big and technical, not too small and superficial, but just right." The print quality is gener-

ally attractive and clear, but the shadow-print output looked strange because the shadow was too far from the original characters.

The handsome control panel includes on-line, line-feed, form-feed, and TOF buttons, as well as three status-indicator lamps. The five conveniently located DIP switches are responsible for controlling straightforward items such as carriage spacing, form length, auto line feed, and serial or line-print mode status. The paper feeds effortlessly, and—at 72 dB—the



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Silver-Reed EXP-550

Silver-Reed America, Inc.

8665 Hayden Pl.

Culver City, CA 90230

(213) 516-7008

List Price: \$649

CIRCLE 798 ON READER SERVICE CARD

using the Power On Default feature(s).
using the bold feature(s).

clacking is not unbearable. Commendably, the EXP-550's manufacturer's specifications closely coincided with my own measurements (Silver-Reed claims 17 cps and my tests indicated a slightly speedier 18.5). I did expect to find greater variation between the speeds of the two different print modes, but the line-print mode turned out to be only 2 cps faster than the serial mode.

The EXP-550 supports proportional spacing as well as 10, 12, and 15 character-per-inch pitches. The availability of

daisywheels is limited compared to printers such as the NEC. The Silver-Reed EXP-550 emulates the Diablo 1610, which makes it a standard printer selection when configuring most IBM software packages.

The Silver-Reed EXP-550 is not the printer of a thousand faces, and it won't win any awards for speed, versatility, or features. It is a thoughtfully designed, well-priced, easy-to-use printer for relatively simple printing applications.

—Robin Raskin



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CIRCLE 180 ON READER SERVICE CARD

PC MAGAZINE • NOVEMBER 27, 1984

303

SPECIAL ISSUE • FULLY FORMED LESS THAN \$1000

		Type	Price	(country)	Dimensions (mm)	Weight (pounds)	Rated CPS	Effective CPS	CPS Quality
Personal Micro Computers	Electric Typing Fingers	Converted typewriter	\$395	Japan	3.0x11.7x5.9	6.0	12	7.8	N/A
Silver-Reed	EXP-400	Daisywheel	\$399	Japan	5.0x15.6x12.4	15.4	10	11.9	11.2
Star Micronics, Inc.	PowerType	Daisywheel	\$499	Japan	5.5x19.6x14.3	25.8	18	20.0	11.7
Dynax	DX-15	Daisywheel	\$499	Japan	6.5x18.3x13.4	19.5	13	14.7	5.2
Teletex Communications Corp.	TTX-1014	Daisywheel	\$499	Japan	5.3x18.3x12.3	17.2	12	14.4	8.7
Silver-Reed	EXP-500	Daisywheel	\$549	Japan	4.8x17.5x12.4	18.7	14	13.2	15.6
Anderson Jacobson	AJ 831	Daisywheel	\$598	USA	33.8x23.5x22.8	90.0	30	28.3	22.8
Comrex International, Inc.	CR-III	Daisywheel	\$599	Japan	6.5x18.3x13.3	20.0	18	18.4	5.9
Sanyo Business Systems	PR-5000	Daisywheel	\$599	Japan	4.8x17.5x12.4	18.7	14	14.2	N/A
Juki Industries	6100	Daisywheel	\$599	Japan	5.9x20.5x14.2	27.5	18	20.3	20.7
Silver-Reed	EXP-550	Daisywheel	\$649	Japan	7.8x22.9x14.9	30.9	17	18.6	11.7
C. Itoh	A10-20R	Daisywheel	\$795	Japan	6.0x21.0x14.0	36.0	18	23.9	N/A
Qume	LetterPro 20	Daisywheel	\$795	Japan	7.5x20.5x14.2	28.6	20	23.6	23.6
Amdek Corp.	5025	Daisywheel	\$799	Japan	6.7x24.4x13.3	24.3	20	20.9	11.5
Brother International Corp.	HR-25	Daisywheel	\$895	Japan	7.6x21.2x15.2	30.0	24	20.6	6.8
Sanyo Business Systems	PR-5500	Daisywheel	\$995	Japan	7.8x23.0x15.0	30.6	16	16.2	N/A
Daisy Systems Holland	M20	Daisywheel	\$999	Holland	7.4x27.1x13.7	30.8	20	22.4	9.0

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters;

DBA	DBA	DBC	Source	Width	Line	Printer	Feeding	Smallest Horizontal	Smallest Vertical	
N/A	N/A	79.0 79.0	—	—	—	—	—	N/A	1/6	
Boldface	65.0	73.0 74.0	UT(O),RSS	R	11.8	10,12,15	H,U,S	P,FL,HT,VT	1/120	1/6
Boldface	60.5	72.0 73.0	UT(O),RSS	R	15.0	10,12,15	H,U,S	P,LH,FL,HT,VT	1/120	1/48
Shadow	65.0	71.0 70.0	UT(O),RSS,RSF(O)	R	15.0	10,12,15	H,U,S,R	P,J,C,LH,FL,HT,VT	1/120	1/48
Shadow print	65.0	72.0 71.0	UT,RSS,PFR	R	15.0	10,12,15	S	FL	N/A	N/A
Bidirectional	65.0	72.0 71.0	BT(O),RSS	R	11.8	10,12,15	H,U,S	P,FL,HT,VT	1/120	1/6
Enhanced type	N/A	77.0 76.0	UT(O),RSS,PFR(O)	R	15.0	10,12	S	LH,FL,HT,VT	N/A	1/48
Shadow print	N/A	77.0 76.0	BT,RSS	R	15.0	10,12,15	H,U,S	P,LH,HT,VT	1/120	1/48
N/A	65.0	71.5 72.0	RSS	R	15.0	10,12,15	—	P,LH,HT,VT	1/120	1/48
Boldface	62.0	79.0 77.0	BT(O),RSS	R	15.0	10,12,15	H,V,U,S	P,J,C,HT,VT	1/120	1/48
Boldface	65.0	72.0 71.0	RSS	R	15.0	10,12,15	H,U	P,J,LH,FL,HT,VT	1/120	1/48
N/A	62.0	70.0 80.0	BT(O),RSS,RSF(O),RP(O)	R	15.0	10,12	H,U,S,R	P,LH,FL,HT,VT	1/120	1/120
Boldface	N/A	73.0 72.0	BT(O),RSS	R	13.0	10,12,15	H,U,S	P,LH,FL,HT,VT	1/120	1/48
Boldface	50.0	73.0 74.0	UT(O),RSS	R	15.0	10,12,15	H,U,S	P,LH,FL,HT,VT	1/200	1/48
Boldface	65.0	72.0 71.0	UT(O),RSS,RSF(O)	R	15.0	10,12,15	H,V,U	HT,VT	N/A	N/A
N/A	65.0	71.0 71.0	BT(O),RSS	R	17.0	10,12,15	—	P,LH,HT,VT	1/120	1/48
Shadow, boldface	62.0	68.0 69.0	BT(O),RSS	R	16.5	10,12,15	H,U	P,J,C,LH,FL,HT,VT	1/120	1/48

AF=Alternate font; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible; (3 0)=DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **# Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary. (O)=Optional.

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Manufacturer	Model	IBM PC Compatibility	Other Printer Compatible	Pages Per Minute (ppm)	Ribbon Type or Refill Type	Ribbon or Refill Cost	Front Panel Controls
Personal Micro Computers	Electric Typing Fingers	L	—	0	—	N/A	O
Silver-Reed	EXP-400	L	—	80	C,CL,CA	\$4.75	O,L,F,P
Star Micronics, Inc.	PowerType	L	Star Micronics	4,096	C,CL	\$5.00	O,L,F,E,P
Dynax	DX-15	L	Diablo 630	3,072	C,CL,CA	\$5.83	O,L,F,P
Teletex Communications Corp.	TTX-1014	L	—	65,535	C,CL	\$8.95	O,L,F,E,P
Silver-Reed	EXP-500	L	Diablo 1610	80	C,CL,CA	\$4.75	O,L,F,P
Anderson Jacobson	AJ 831	L	—	256	C,CA	\$5.80	O,L,P
Comrex International, Inc.	CR-III	L	—	5,120	C,CL	N/A	L,F,E,P
Sanyo Business Systems	PR-5000	L	Diablo 1610	0	C,CL	N/A	O,L,F,P
Juki Industries	6100	L	—	2,048	C,CA	N/A	O,L,F,E,P
Silver-Reed	EXP-550	L	Diablo 1610	0	C,CL,CA	\$6.00	O,L,F,E
C. Itoh	A10-20R	L	—	200	C,CL	N/A	O,FL,P
Qume	LetterPro 20	L	—	0	C,CA	N/A	O,L,F
Amdek Corp.	5025	L	—	2,048	C,CL	N/A	L,F,E
Brother International Corp.	HR-25	L	—	3,072, 5,120(O)	C,CL	N/A	O,L,F,E
Sanyo Business Systems	PR-5500	L	—	2,048	C,CL	N/A	O,L,E,P
Daisy Systems Holland	M120	L	Diablo & Qume	500	C,CA	\$7.20	O,L,F,P

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front, R=Rear, B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible, (3.0)-DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary. (O)=Optional.

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RANA 1000..\$255

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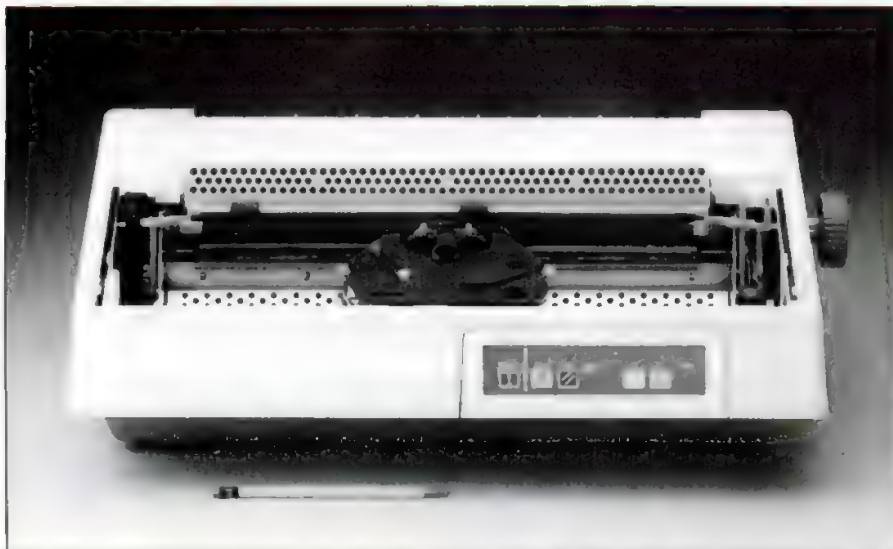


Ricoh 1500Q

I have the feeling that the Ricoh 1500Q letter quality printer is a machine that nobody wants to sell. It sat here for a month waiting to be tested while I waited in vain for the manufacturer to send some documentation. None had been packed with it, and though Ricoh's representative promised to send some, it never arrived. With *PC*'s publication deadline fast

approaching, the only way I could review this machine was to take a blind shot at getting it operating.

Fortunately (or perhaps unfortunately), a few days earlier I had tested what appeared to be its identical twin wearing the Amdek label. I'd had a problem setting up that machine and also had difficulty obtaining technical support from Amdek. (Nobody wants to sell this machine under any name.) But at least this time I knew where to look among the DIP switches when the 1500Q didn't go right on-line.



Wq

using the Power On Default feature(s).



1500Q
 Ricoh
 5 Dedrick Place
 West Caldwell, NJ 07006
 (212) 861-5778
List Price: \$1,489

CIRCLE 701 ON READER SERVICE CARD

In fact, I can't think of any good reason that this printer shouldn't come out of the box ready to go, no matter whose marketing label it's wearing. Almost all printers use DIP switches to set parameters, and many manufacturers anticipate their probable end use well enough to preset them at the factory and save the customer the trouble. You should be able to just plug any printer in and make it do at least ordinary, unembellished printing without reference to a manual.

Be that as it may, using massive amounts of persistence, I managed to call up various special features, largely by drawing on a repertoire of standard escape sequences and voodoo incantations that an average buyer can't be expected to have. I think it was after I loudly threatened to smash it into little pieces that we really began to make some progress. It turned out that it does underlining and boldface and shadow printing and tabs and subscripts and—ho hum—other things most machines out there also do.

I really can't recommend the Ricoh 1500Q. There are so many other printers to choose from in today's market, why put up with poor support from whatever company sticks its name on the finished product? —**Jim Forney**

Spinwriter 2050

When I started to review printers, I never imagined I'd have to build one first! I make a point of avoiding any "assembly required" computer hardware. I had to psych myself for installing NEC's IBM interface module to endow my NEC printer with IBM compatibility.

The NEC 2050 is like a chameleon. By using different interface modules, you can blend the NEC 2000 series printer into a variety of environments. Two serial interface modules, a parallel interface module with ASCII escape sequences, and the 2050 parallel interface with IBM escape sequences all come with the package. The entire rigamarole is NEC's response to the

steel printers à
But, at \$1,250
, it's still a far

variety of system
2000 series may
ersatility you need.

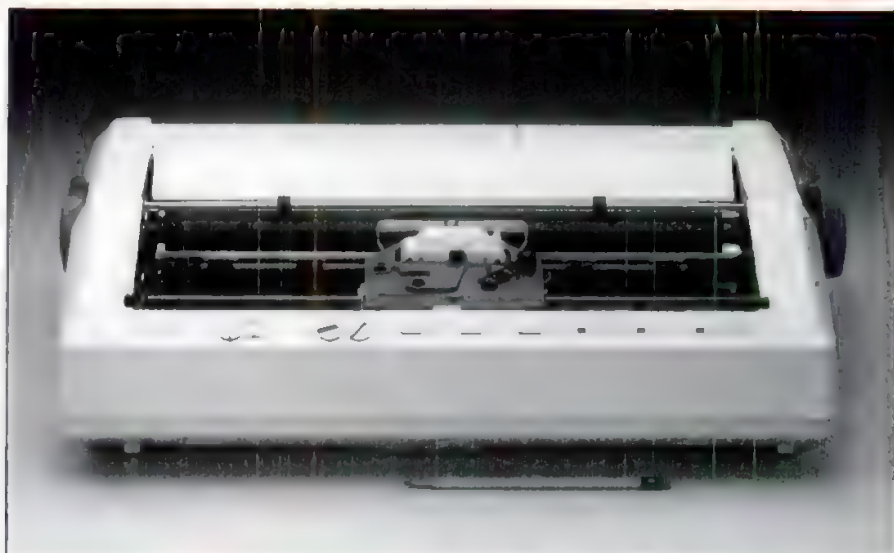
simply a cute gimmick that
duplicates you into thinking you've saved a
few cents because you did it yourself.

There are a great many things I like
about NEC's printers. Their manuals are
tried-and-true classics. Their print quality
is an industry standard. The printer has a
respectable 23-cps speed and is capable of
printing 10, 12, and 15 cpi as well as pro-
portional spacing, and NEC's IBM com-
patibility is a time-tested fact. The NEC
2050 is easy to keep fed. Ribbons and
thimbles are abundant, and the combina-
tion of the paper-release lever and paper-
feed control lever makes all paper manip-
ulations smooth and fluid.

NEC appears to have the best interests
of word processing users in mind. That
concern is most clearly demonstrated in
the manual. The 2050 manual includes
an appendix that specifies precise instruc-
tions for configuring the printer to nine
major IBM software packages including
WordStar, *MultiMate*, and *VisiWord*.

The NEC 2050 is obviously the com-
pany's low-budget model. The front pan-
el's indicator labels are taped on with ill-
fitting transparent tape that is a delight to
pick and poke at while waiting for a doc-
ument to print. (My machine would be
labelless after its first day on the job.) It is
slow—a full 3 to 4 seconds elapse from
the time the power switch is clicked on to
the time the machine is powered up. My
top-of-form button didn't work at all.
And, the machine clatters like an angry
woodpecker between intermittent loud
whirs from the step motor.

My most serious complaint is that I
required an emergency visit from the NEC
serviceman to get my printer to work.
When I used the switch settings in the
manual, the printer wouldn't print a thing.
When I turned it on, it sounded as if I'd



Wq

Spinwriter 2050

NEC Information Systems, Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000
List Price: \$1,250

CIRCLE 746 ON READER SERVICE CARD

using the Power On Default feature(s).
using the bold feature(s).

thrown pebbles into a blender.

The problem, it was discovered,
stemmed from the design of NEC's two
rotary switches on the front panel. One
sets the form length in total number of
lines per page. The second is a thimble-
select switch that must conform to the cpi
of the installed print thimble. That switch
was set to an automatic-sensing setting
that does not work with the IBM PC. The
serviceman, manual, and NEC spokesper-
son could not agree as to whether the front
panel on my machine was actually the

front panel for the 2050.

If the auto-sensing features are going to
be prominently displayed on the front pan-
el, the IBM user ought to be able to use
them.

I also found the printer's software to be
incongruous. Even though NEC claims
compatibility, some of the features were
disabled by the printer's automatic car-
riage return while others were not. This
lack of standardization could most as-
suredly stymie certain word processing
configurations.—Robin Raskin

Sellum Pro 3500Q

What looks like an NEC Spinwriter 3400Q, has a label that says it's a NEC Spinwriter 3400Q, but may or may not act like one? Racked your brain long enough? Okay, I'll give it away. It's a Sellum Pro 3500Q.

"What about the label on the machine that identifies it as an NEC Spinwriter?" you ask. Also, what about this manual that

popped out of the box? It says it's from a company called Intek. This doesn't make sense. The documentation links Intek to Sellum, but there's no mention of NEC except in listings of printers like Diablo, IBM/Epson, Qume, and Atari. The manual has no drawings or pictures to show you what a Sellum printer looks like, or even how to unpack and install it.

I finally gave up trying to figure it out and called Intek in California to get some answers. The woman who answered the telephone didn't have to put me on hold.

She knew all the answer. before long the whole thing b. to me.

A Sellum starts life as a NEC Spinwriter, but before it goes to market, Intek grabs hold of it and installs a circuit board of their own design. The transplant transforms it into a Sellum, and as a Sellum it's suddenly compatible with the printer command codes for Diablo, IBM/Epson, Atari, Qume, and even the made-for-IBM NEC 3550, as well as with the too often incompatible NEC codes. In short, the change solves software compatibility problems often associated with NEC printers. The extra \$100 cost for this newfound compatibility is well worth it. Someone in the office, familiar with NEC printers, quickly volunteered that he'd spend 3 times that cost for it.

The Sellum circuit board contains a Z-80 microprocessor and 64K of RAM, so there's a little powerhouse in there. A full 48K of that RAM can be used as a print spooler, which takes a good load off your PC.

To know whether the printer is an NEC or a Sellum, you have to look inside the machine. If it's a Sellum, it will have an Intek label and serial number on the bottom pan.

The altered NEC can only emulate the protocols of one printer at a time. You make the choice of printer by setting three DIP (dual in-line package) switches on the Sellum circuit board. The switches are easily accessible at the top of the board, within reach when you open the top of the Spinwriter. The Sellum manual provides you with the escape sequences for each protocol that supports the particular feature you're looking for.

If you'd like a NEC Spinwriter but can't tolerate incompatibility, the Sellum may be for you. In fact, if you've already got a Spinwriter you can't stand, contact Intek. They told me that, although they can't put the Sellum board in existing printers, they can retrofit any Spinwriter and achieve pretty much the same results.—Jim Forney



Wq

Sellum Pro 3500Q

Intek Manufacturing Company Inc.
780 Charcot Ave.
San Jose, CA 95131
(408) 946-9041

List Price: \$1,995

CIRCLE 712 ON READER SERVICE CARD

using the Power On Default feature(s).

C. Itoh Starwriter F10-40 and Printmaster F10-55

The only differences between the Starwriter F10-40 and the Printmaster F10-55 are \$200 and 15 cps. The same commands work on both printers, and both feature outstanding print quality. The question is: Why would anyone sacrifice 15 cps on a daisywheel printer for a cost savings of just 10 percent? With that in mind, you can consider this a review of the Printmaster F10-55 and then forget about the . . . uh . . . what's its name?

The manufacturer specifies the Printmaster F10-55 at 55 cps (hence its designation), but I tested it at 44 cps—not too far off the mark. The default print mode is gorgeous letter quality, with Diablo print-wheel compatibility. Changing print-wheels or ribbon cartridges (there is a black/red cartridge option) is, literally, a snap, and you won't smudge your fingers.

The printer sent to *PC* was supposed to be ready for action, but the commands for proportional spacing, underlining, boldface, and shadow printing didn't work. A technical rep from C. Itoh told me that it needed an optional 2K memory buffer (the printer is unbuffered) to enable those features. The company was unable to supply the buffer in time, so I cannot report on the proportional spacing, boldface, and shadow enhancements, probably the machine's snazziest features.

The technical rep was also a little confused about single sheets of paper. He said an automatic sheet feeder was necessary to use them, but that this device came from a third party, not from C. Itoh. Still, I was able to print single sheets by loading them manually, a simple operation on this machine, much like inserting paper into a typewriter.

A 15-inch carriage is standard, so the printer occupies plenty of space. It also tends to invade your mental space—when

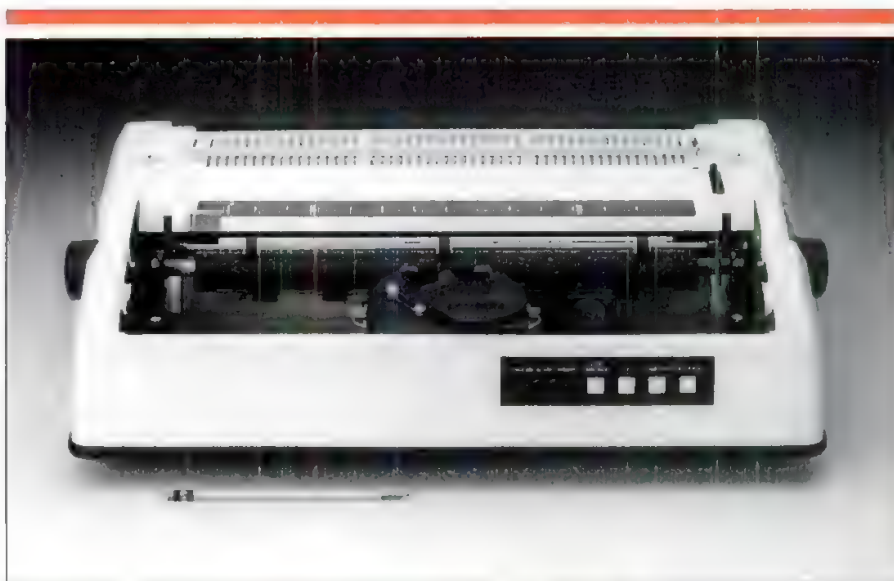
printing, it sounds something like a jackhammer on the other side of a thick wall. Even when it isn't printing, it emits a high-pitched whine reminiscent of an airplane ready for takeoff. But at least you won't hear your PC's fan motor anymore!

The attractively modern cabinet allows easy access to the guts of the machine. An under-the-hood switch lets you choose from proportional spacing, pica, and elite pitches. The well-designed front panel holds three lamps and four buttons. The lamps indicate on-line/off-line, error alert,

and power, while the buttons control the on-line/off-line status, line feeds, form feeds, and page set, which sets the carriage at the top of the form.

Two manuals are included, one from C. Itoh and the other written by Leading Edge. You can get by with either one, but the latter is better organized, better written, and easier for the novice to use. In fact, the Leading Edge manual helps you learn to use the Printmaster almost as quickly as it prints.—Phil Wiswell

(continued)



Starwriter F10-40 and Printmaster F10-55

C. Itoh Digital Products
1011 Francisco St.
Torrance, CA 90502
(800) 348-1984
(213) 327-5939

List Price: \$1,795 and \$1,995

CIRCLE 774 ON READER SERVICE CARD

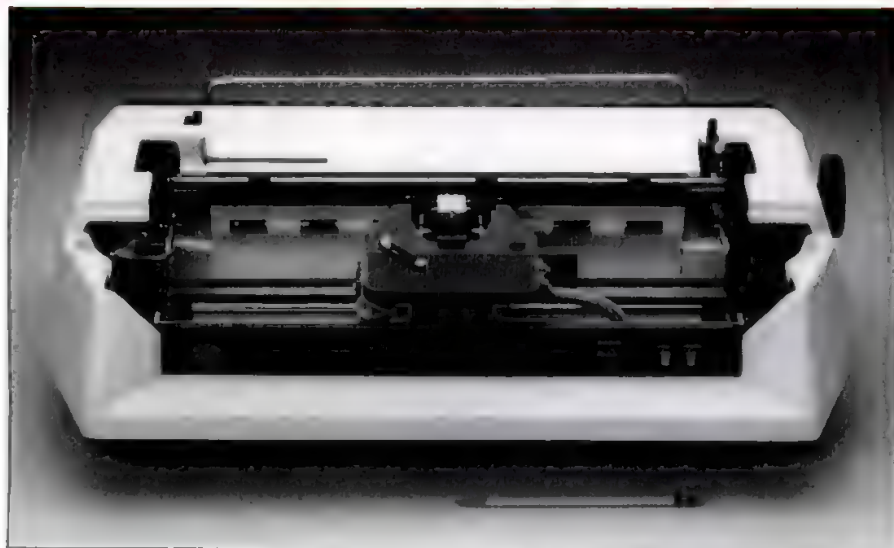
using the Power On Default feature(s).

Daisy M45

The Daisy Systems M45 Daisy Wheel is a printer only a hacker could love. Whoever designed this machine and its accompanying documentation ignored all established concepts of sanity in printer design. The Daisy M45 is a strong, fast (43 cps) printer that is extremely difficult to use.

I was plagued by problems from the

moment I unpacked this machine. The "cover-open" activator switch was so sensitive that I had to poke it off with a pencil before I could get the printer to begin working. Made in Holland, the Daisy Systems's printer's appearance, style, and documentation seem extraordinarily primitive compared to its American and Japanese counterparts. The user's manual was particularly painful, featuring misused phrases, poor-quality photographic illustrations, and a generally hard-core engineering orientation.



Wq



Daisy M45

Daisy Systems Holland BV
4646 Bell Dr.
Chamblee, GA 30341
(404) 451-0257

List Price: \$1,695

CIRCLE 795 ON READER SERVICE CARD

using the Power On Default feature(s).

The printer works with both serial and parallel interfaces, which contributed to my initial troubles. Using the switch settings in the rear of the printer (there are 32 settings: two eight-position rotary switches and two banks of eight DIP switches), I valiantly tried to configure the printer to my PC.

No matter how I set the switches, the results were always gibberish. When I called Daisy Systems for advice, an engineer suggested I rotate Switch 1's position. I protested, pointing out that the manual identifies Switch 1 as the baud-rate setting, which should not matter for a parallel interface. It was then the engineer confessed that, although he didn't exactly know why, he was certain that setting the switch to 1200 baud would solve the problems. It required the finesse of a surgeon to click the tiny rotary switch into place, but, sure enough, when I set Switch 1 to 1200, the parallel interface decided to cooperate.

This is indicative of Daisy Systems's disregard for the user's sense of logical design. Instead of specifying print features with familiar terms like boldface or double strike, this manufacturer forces you to think in terms of programming the printer's hammer intensity, ribbon distance, and carriage movement. Instead of using terms like shadow printing, subscripts, and superscripts, you must specify horizontal and vertical displacements. Many of the printer's programmable features require four- and five-character command sequences.

The Daisy Systems M45 does have a graphics mode where carriage movement is independent from printing. You can set it to move the carriage either $\frac{1}{60}$ or $\frac{1}{120}$ of an inch.

In short, the Daisy Systems M45 is compatible with the IBM PC, but only after a significant amount of twiddling. "Fred B. User" doesn't stand a chance. The Daisy M45 is highly compatible with Excedrin, Anacin, or any other major pain reliever. But, for \$1,695, who needs a headache?

—Robin Raskin

M45 Quiet Write

What do you do if you want to introduce a car to compete head-to-head against GM, Ford, and the Japanese imports? Assuming you're not John DeLorean, is your best strategy to price it competitively? Give it some truly snazzy features? Make sure it can really perform? Or would an outstanding owner's manual make a difference?

Daisy Systems Holland was faced with a similar situation as it prepared to begin selling its printers in the American market. Unfortunately, it chose to answer "No" to all of these approaches.

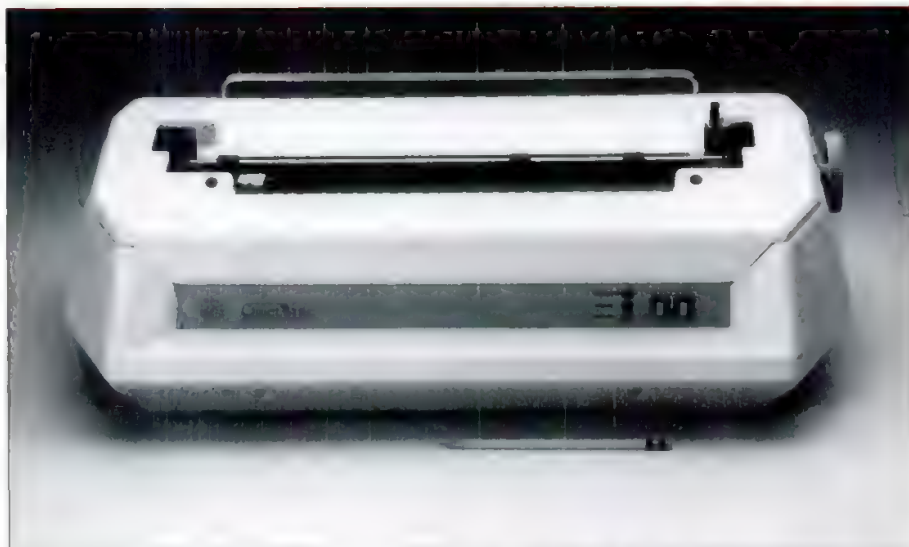
Daisy rates its M45 at 45 cps, while PC's benchmark test generated only 37.1 cps. Although the print sample accompanying the M45 displayed some nice type features (proportional spacing, boldface, underlining, subscripts, and superscripts), the manual was so incomprehensible that I couldn't get these features to work.

Like many printers, the M45 is stricken with a common malady: It's a basically sound unit crippled by a horrid manual. It has the potential to perform as a decent daisywheel printer, but the current manual makes that impossible.

If every cloud has a silver lining, the M45's is its capacity to use both Qume and Diablo printwheels. Unfortunately, when taking into account the overall performance of the unit, a more appropriate metaphor might be "every tornado contains some loose change."

The M45 cost \$1,845 with its standard typewriter-style roller. A clip-on bidirectional tractor feed adds \$335 and a single-sheet feeder costs \$635.

Ultimately, the M45's problems cut deeper than any specific deficiency. Even with a well-written manual, and even if everything worked as advertised, the M45 simply wouldn't offer anything to make it stand out from better-known printers manufactured by companies with proven track records. —Gary Markman



Wq

M45 Quiet Write

Daisy Systems Holland BV
4646 Bell Dr.
Chamblee, GA 30341
(800) 423-2479
(404) 451-0257
List Price: \$1,845

CIRCLE 723 ON READER SERVICE CARD

using the Power On Default feature(s).

Diablo Series 36

Xerox, the company that owns Diablo Systems, seems determined to create as much confusion as possible around the Diablo Series 36 daisywheel printer.

The first source of confusion is the name. After unpacking the box, I checked the serial-number plate on the printer. It said the machine was a Model 620! After running the tests on it, I packed it up and

moved on to another Diablo printer. This one, according to its nameplate, was a plain Diablo 36. But according to the serial-number plate it was—you guessed it—a Model 620.

After two calls to Diablo, I learned that the two printers were identical except for the nameplates. The woman I spoke to had no idea why they were labeled differently. My comments, then, apparently apply to the Series 36, the 36, and the 620, depending on how you look at it.

If the printer's name were the only

Business or pleasure, we're your one-stop

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NEC
3550 letter quality 33 CPS **See Box**
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OKIDATA
OKI-92 **Call** **OKI-84** **Call**
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Compact R/O parallel and serial letter quality **369.95**

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KXP-1090 80 CPS F/T **269.95**
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
CROSSTALK XVI Communication software	\$98⁵⁰
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Wq



Diablo Series 36
 Diablo Systems, Inc.
 P.O. Box 5030
 Fremont, CA 94537
 (415) 498-7000
List Price: \$1,595

CIRCLE 757 ON READER SERVICE CARD

using the Power On Default feature(s).

source of confusion, it wouldn't be such a big deal, but other problems complicated the situation. First, the printer is not at all difficult to install—if you have the proper cable. Unfortunately, Diablo managed to send *PC* the wrong cable even after being told that the printer was going to be tested on an IBM PC and should be supplied with a special cable if it needed one. The cable Diablo supplied plugged into the printer at one end and the parallel port of an IBM PC at the other. Naturally, it didn't work.

Combing through the manual, I finally

realized, by reading between the lines, that the Series 36 is IEEE compatible, RS-232 compatible, and Centronics compatible all at once. It turned out that all you do is just plug in the correctly wired cable: No switches need to be set, which seems to be a nice, thoughtful feature. But Diablo hasn't seen fit to clearly explain any of this in the manual. Diablo also neglects to mention that the cables are identified with small white plastic tags—and I can vouch for how easy they are to overlook. The cable you want is labeled IBM; the version

Diablo sent was labeled RS-232.

The manual is confusing in other ways too. It looks good enough, but I wish Diablo had spent more money writing it and less on production. It does a rotten job of explaining what you need to know. When listing the commands for various print enhancements, for example, it doesn't describe what the enhancements do.

An even better example of the manual's limitations cropped up when I set up the second printer and the printwheel somehow got installed backwards. The printer steadfastly refused to work, insisting on blinking its status light at me instead. All well and good, but the manual does not list "check the printwheel" as a response to a blinking status light. Since the wheel seems to fit either way, Murphy's Law guarantees that you will eventually need to know about this.

I might forgive all this if Diablo offered solid technical support to help sort out the difficulties. It doesn't seem to do so. The people I talked with at Diablo were very helpful, but reaching them through the company's maze of busy signals and answering machines (the kind that don't take messages) was nearly impossible. And I did make it clear that I was calling from *PC Magazine*.

When you finally get the Diablo what's-its-name up and running, it does work. It's not amazingly fast or quiet, but it is in line with others in its price range. I was pleased to see that it does not hang up on the high-order character set but prints low-order characters instead. All of which, I believe, qualifies as damning it with faint praise. —M. David Stone

Daisywriter 2000

The Daisywriter 2000 daisywheel printer comes out of the box like a rodeo bull—obstinate and difficult to handle. This is not a printer you can expect just to plug in and live with happily ever after.

The printer's nonstandard cable has only a naked card edge exposed through

an opening in the back of the cabinet. The one I tested came with the proper card grabber at one end but an incompatible connector at the other. Even after I found a suitable cable, the printer didn't seem happy. It wouldn't print screens or programs. It ran its self-test to prove it was just sulking and not dead, but it didn't want anything to do with a genuine IBM PC.

It turned out that several DIP switches were set incorrectly, which could happen easily enough, since there are 24 of them. It appeared, though, that the factory had done virtually nothing to make the printer ready to run without modification. The manual showed several switch configurations to match up with various computers, as well as one called "Daisykey" and another cryptically called "Dumbwriter." I assumed that since I was plugging it into a PC, that was how I should set the switches. Wrong! The Daisywriter 2000 doesn't want to know about PC; it wants its Daisykeys. The difference is that the command sequences use ! or @ instead of Esc to call up special features.

Once that was resolved and the Daisywriter 2000 had shown me who was boss, we got along fine. The printer has a lot of nice features. Without adding any enhancements, it prints very crisp-looking text, which is just what you're looking for in this kind of printer. And in its normal mode it runs at a 20-cps speed that is fairly characteristic of its breed.

The boldface enhancement is very bold, but it slows the printer down to about a third of its already leisurely pace. Shadow print, another attention-getting enhancement, double strikes each letter with a slight horizontal offset, leaving a sliver of white between the strikes. And the printer underlines, does subscripts, superscripts, and many other things as well.

So, if you're looking for print quality rather than speed, you might want to look into the Daisywriter 2000. But if you decide to buy it, save yourself some aggravation and ask the dealer to set it up for your PC before you take it home.

—Jim Forney

Silver-Reed EXP-770

At 31 cps, the EXP-770, Silver-Reed's top-of-the-line printer, prints 13 cps faster than the EXP-550, Silver-Reed's next-best printer. The 770 also comes with a standard 2K buffer that can be expanded to 8K, 16K, or 48K with the installation of an optional memory card. Both a Centronics parallel interface and an RS232C serial

interface are available.

Another major advantage of the 770 over the 550 is its Diablo 630 emulation. This feature brings to the 770 a whole world of word processing software denied its little brother. The Diablo protocols support underlining, double strike, boldface, and superscripts and subscripts. As a bonus, you get a simple vector-plotting mode, as well as the ability to download printwheel tables for using daisywheels with unconventional character arrangements.

(continued)



W q

Daisywriter 2000
Computers International
P.O. Box 60677
Terminal Annex
Los Angeles, CA 90060
(213) 386-3111
List Price: \$1,495

CIRCLE 729 ON READER SERVICE CARD

using the Power On Default feature(s).
using the RT MARGIN 70 feature(s).
using the RT JUSTIFY feature(s).
using the PROPORTIONAL SPACING feature(s).



Wq

EXP-770

Silver-Reed America, Inc.
19600 South Vermont Ave.
Torrance, CA 90502
(213) 516-7008

List Price: \$1,295

CIRCLE 776 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Double Strike feature(s).
using the Bold feature(s).

Visually, the 770 is simple and stylish, if you like office gray. It also appears to be solidly constructed. No parts jangle, whine, or scrape.

The handsomely printed operating manual features easy-to-follow instructions accompanied by numerous diagrams and well-labeled photographs. Although it offers neither cute cartoons nor footnotes chronicling the history of movable type in the West, the manual is very readable and should be understood by most users.

The front panel of the 770 is simple but

functional. The green Power lamp warns you that you've left the printer on, the red Alert lamp tells you something's wrong, and the yellow On-line lamp indicates the printer is ready to roll. Next to these lamps are four buttons: On-line toggles the ready state if you want to interrupt printing; Line Feed advances the paper one line; Form Feed advances a page; and TOF Set indicates that the paper is positioned at the top of the form.

The manual controls along the top of the printer are comfortable to use. They

Diablo 630 emulation brings word processing software to the EXP-770.

include the power switch, a paper-release lever, and a paper-bail lever as well as platen knobs, a paper injector, and an acoustic hood that effectively dampens noise.

If you intend to let this printer run off more than a few pages unattended, you'll need the optional tractor feeder. This feeder, which is identical to the one used on the 550, lists for \$159. Unfortunately the feeder is incompatible with the acoustic hood, so you'll have to get used to the clatter.

The EXP-770 takes Olivetti ET cartridge ribbons and comes shipped with a multistrike ribbon. A more expensive carbon ribbon is also available, but its impression is anorexically crisp and wiry. The multistrike ribbon produces a slightly thicker and darker impression, whereas the continuous fabric ribbon lightens fairly quickly.

The EXP-770, and the Silver-Reed line in general, exemplify a new plateau of product maturity brought about by technical excellence and characterized by three little words: simple is better.

—Dean Hannotte

Brother HR-35

Despite its wide body, Brother's HR-35 daisywheel printer has a sleek, modern design that makes it seem to take up less space than machines with similar footprints. And this theme of good design extends to the way the printer operates. It is a machine you would be both proud and

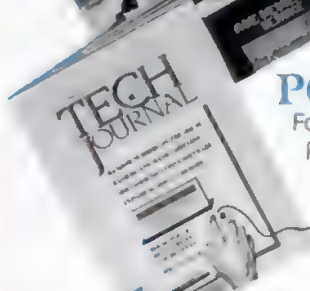
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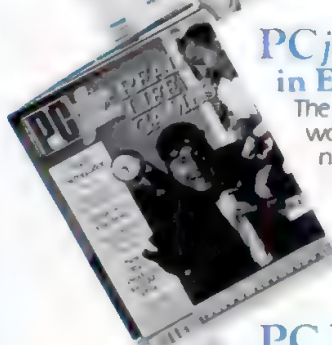
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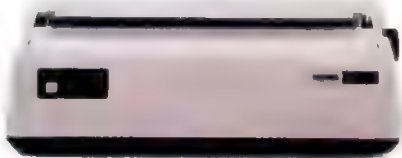
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CIRCLE 285 ON READER SERVICE CARD

pleased to own, use, or display.

The most noticeable feature of the HR-35 is the array of touch-sensitive buttons on its front panel. Pushing the button labeled Pitch lets you select among 10, 12, and 15 cpi, or proportional spacing. Line allows you to set line spacing in a similar fashion. You use the Copy button to select the number of copies of the document you want printed. This piece of "human-engineered hardware" is just what people who are tired of those hard-to-reach little DIP switches and convoluted escape codes have been waiting for.

The HR-35 also features a single, yet

The HR-35 is one high-technology machine that can easily be controlled by low-technology humans.

effective, automatic paper-loading mechanism. Open the paper release lever, insert the paper until it stops, close the lever, press the top of form switch, and bingo—the printer rolls the paper up to the first printing position, 1.2 inches from the top of the page. The manual friction feed paper roller works in both directions; so adjustments are no problem. You can also buy optional tractor drives and cut-sheet feeders.

The easy process of changing the daisywheel, the black ribbon cartridge, or the red ribbon cartridge (an optional and separate ribbon installed above the black one) won't smudge more than a single careless

finger. Brother offers daisywheels for ASCII, international characters, and 14 languages, and each of these is available in a wide variety of fonts, including script and italics.

The exceedingly clean and well-formed type in the default draft mode prints at 33 cps, 1 cps more than the manufacturer's rating. I would feel free to use this mode for nearly all my work, without fear that some fussy editor would complain. Proportional spacing makes it even more readable. The bold and shadow print

sets, which print at 12 cps, are gorgeous, wonderful for emphasizing titles and subtitles.

The documentation is one of the best examples of combined brevity and clarity I've read, and a profusion of extremely well-drawn illustrations make the first-time user feel confident enough to try out the features that seem worthwhile. The HR-35 is one high-technology machine that can be easily controlled by low-technology human beings. —Phil Wiswell

(continued)



FACT FILE

HR-35

Brother International Corp.
8 Corporate Pl.
Piscataway, NJ 08854
(201) 981-0300

List Price: \$1,245

CIRCLE 720 ON READER SERVICE CARD

using the Power On Default feature(s).
using the double print set feature(s).
using the bold feature(s).
using the double print, shadow feature(s).

Fujitsu SP320

Let's hear half a cheer for the Fujitsu SP320. This unexpectedly speedy daisywheel printer was well on its way to becoming the day's most pleasant surprise—until it exhibited its fatal flaw (and I mean fatal).

The good news first. The SP320 is both an RS-232 serial printer and a Centronics-compatible parallel printer, depending on

how you use it (it can also function as a current loop device).

Setting up the printer is mostly a matter of plugging in the proper cable and setting the DIP (dual in-line package) switches. This may sound simple, but it wasn't simple when I tried it. The problem is that the essential information is hidden in a manual titled *SP320 Interface Specifications, Centronics and RS 232*, written in just the kind of "technobabble" you would expect. As a result, in my first attempt, I plugged in a serial cable but wound up

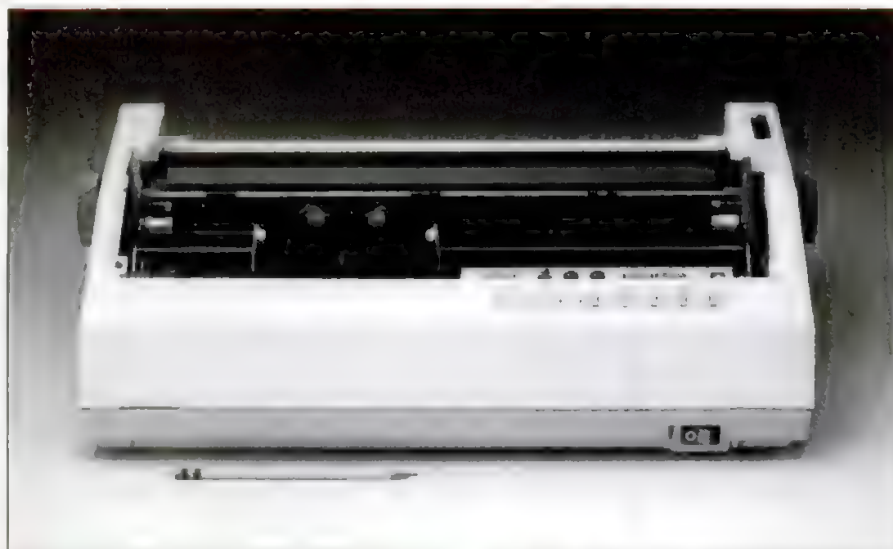
setting the printer to use the parallel interface. All of this means that unless you are very familiar with printers, you will probably need help setting up.

When you do get the SP320 to work, you will find that it speeds along at a pleasant 40.6 cps, about 2 cps faster than we found the Diablo 630 ECS to run. Although the SP320 is not the noisiest daisywheel I've ever dealt with, it is not the quietest one. I'd rather not be around when it's doing its job. I mention this here because you will not find a tested noise rating for the SP320 in our chart. The printer died before we could run the test. And thereby hangs a tale.

In testing the printers for this project, we tested noise level last. We brought each printer to a quiet room set up for this purpose. When I was ready to test the SP320's noise level, I unplugged the printer, carried it to the quiet room, and plugged it back in. I then wondered why it wouldn't turn on.

The reason was that a fuse had blown—not the fuse in the back of the printer, which was easy to get at, but a fuse on an internal circuit board, which required taking the printer apart. After some effort accompanied by anger at the individual who designed the SP320, I found yet another blown fuse.

A call to Fujitsu elicited the "helpful" information that unplugging the printer and plugging it back in before the capacitors had had a chance to discharge "sometimes caused a problem." They said they were "aware of the problem and were working on it." I wish them good luck, but until they solve the problem and start shipping printers that work, I'd stay away from this one. —M. David Stone



Wq

SP320

Fujitsu America
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777
List Price: \$1,499

CIRCLE 695 ON READER SERVICE CARD

using the Power On Default feature(s).

TeleVideo TP 750

For every printer that attempts to supply more features than you'll ever possibly need, there's always one that leaves you with little more than you get from a typewriter. The TeleVideo TP 750, unfortu-

The TP 750 is quick, and its character set is well formed, but it does little more than print text.

nately, is one of the latter.

Actually, it's worse. TeleVideo not only charges extra for the tractor feed (\$250), a practice that is not uncommon, but it also does not include many features usually considered standard, such as bold print and underlining (\$25 extra), in the base price. That wouldn't be so bad if it weren't for the TP 750's price. At \$1,595 it's not an inexpensive daisywheel printer. Charging an additional \$25 for print enhancements that are standard on comparably priced printers is outrageous.

The manufacturer failed to supply PC with the options, so I cannot comment on any of the TP 750's print enhancements except to say that they are available—for the extra fee, of course.

Wait—I take that back. The news is that TeleVideo has changed its mind. It will ship the TP 750 with all the print enhancements installed on a 16K PROM cartridge as standard equipment this fall. As of this writing, the company still hasn't decided whether it will compensate those who bought the unenhanced or added-cost versions of the printer.

Although the TP 750 is quick (42.1 cps), with a crisp, well-formed character set, it does little more than print text. Until now, with the change in company policy, it has offered virtually none of the enhancements considered standard for daisy-wheel printers in its price range. It can, however, set and clear margins and tabs, designate the top of form and lines per page, and suppress print. You can print

text at 10, 12, or 15 cpi. Although you cannot access subscripts and superscripts directly without the added cost of the enhancement, you can use half-line feeds to insert them in the text you print.

In addition to the standard buttons for form and line feeds, the control panel includes two lamps for signalling mechanical errors. One indicates a problem in the printwheel or carriage; the other, in the buffer, ribbon, cover, or paper. The DIP switches, located behind the front cover, permit control of the form length, horizon-

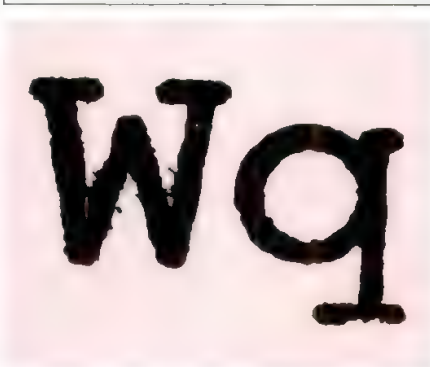
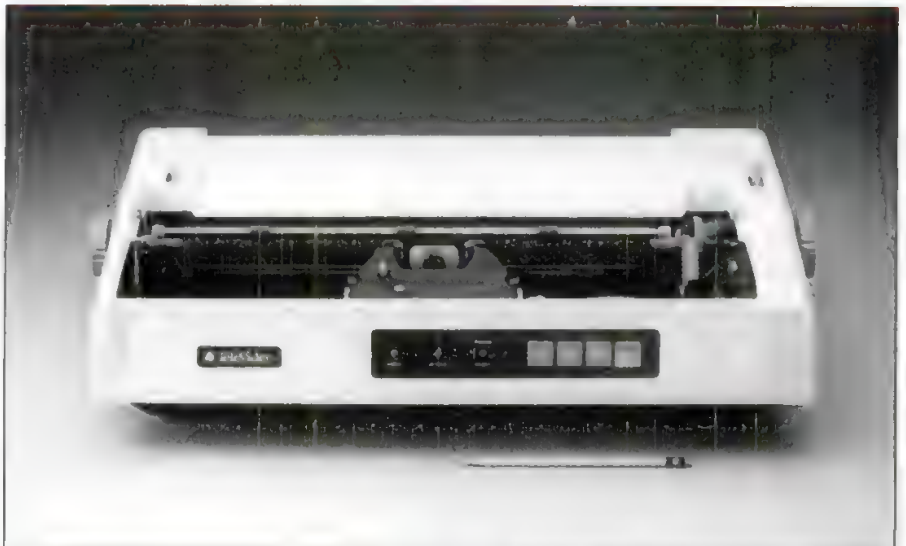
tal and vertical pitches, auto line feed, and type of printwheel. The TP 750 uses any of eight different Mechatron printwheels.

The manual (what little there is of it) is well illustrated and clearly written. It also includes an appendix, which lists all the optional enhancements.

I cannot state whether the TeleVideo TP 750 with the print enhancements is a decent printer. Without them, however, the printer is not worth considering.

—Vincent Puglia

(continued)



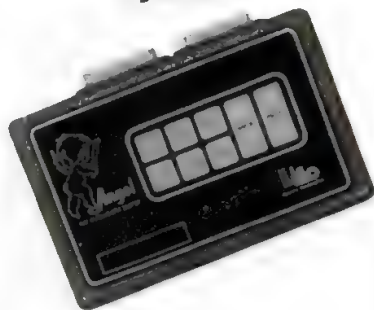
TeleVideo TP 750
TeleVideo Systems, Inc.
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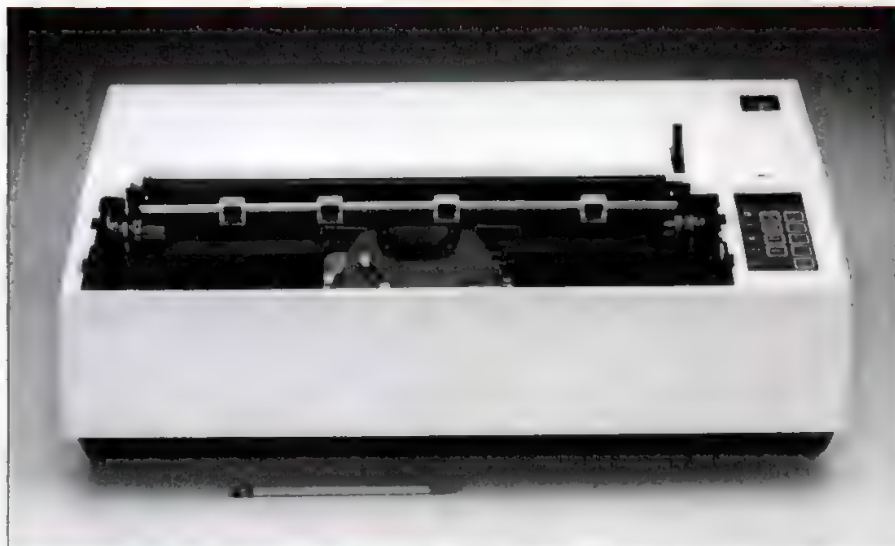
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Primages Image I

Successful entrepreneurs often create the best microcomputer products, including printers. In 1979, three men working on their own developed a new method of controlling stepper motors so as to replace more expensive servo motors in certain applications. This innovative method and its resulting patent form the basis of the Image I daisywheel printer, which is in

turn the basis of Primages, Inc.

The first time I removed the cover of the Image I, I was surprised by the absence of the taut steel cables found in most letter quality printers. Instead, I saw a simple mechanism resembling the shaft of a large screw. This is the carriage-positioning mechanism. As it turns, the printhead follows its motion back and forth across the platen. I was even more surprised later that day when I found the same mechanism in an IBM printer costing almost three times more.



Wq

Image I

Primages, Inc.
620 Johnson Ave.
Bohemia, NY 11716
(516) 567-8200
List Price: \$1,875

CIRCLE 785 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Auto Underline feature(s).

using the Bold Print feature(s).

using the Shadow Print feature(s).

This new technology allows the Image I's relatively fast 45-cps printing speed. Because the special daisywheels have 100 spokes, they can contain all the special characters and accent marks to print any roman-alphabet language without changing wheels. Primages supplies several different fonts on separate daisywheels.

This well-designed printer offers both a parallel and a serial port as standard equipment. The serial port supports both an ETX/ACK and an XON/XOFF protocol at up to 9600 baud. The microprocessor-based circuitry adjusts to the language of the current printwheel to allow a one-for-one mapping of character codes. The Image I allows printing at 10, 12, 15, or 20 characters per inch in addition to the proportional spacing mode.

The Image I's price seems low for a printer with these capabilities, but, after all, who can argue with a bargain?

Have I left out anything? Oh yes, Primages seems very proud of its optional sheet feeder, which it claims was designed as part of the printer itself. This allows the company to produce it at an unusually low cost. I had some trouble making this engineering marvel work at first, but a quick call to the factory solved the problem.

The most surprising aspect of the Image I is its \$1,875 price. This seems low for a printer with all these capabilities, but I guess that's the prerogative of three lone entrepreneurs. And, after all, who can argue with a bargain?—**Bill Harts**



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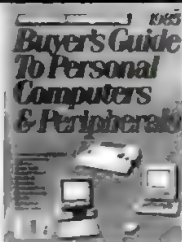
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Comrex ComRiter IV

The first thing I noticed about the ComRiter IV was that its front-panel controls are identical to the Brother HR-35's in every way.

Its three lamps—for power, alarm, and on-line/off-line—are familiar, and, of course, so are its Form Feed, Line Feed, and Top-of-Form buttons. It also shares the Brother HR-35's unusual, but convenient, controls for selecting line pitch, print pitch, and number of copies to be printed. Like the panel on the new Brother daisywheel machines, the ComRiter IV gives you a great deal of fingertip control from the outside.

The second observation I made was that the cabinet and 15-inch carriage of the ComRiter IV are identical to those of the HR-35. Both are sleek and modern-looking, and both are dust-proof printers. Unfortunately, the ComRiter IV is also noisy. Each time the printhead stops, the motor whines and whirs for a few seconds, then shuts off. It's just loud enough to be annoying.

Loading paper into this printer is a breeze, almost fun, with the semiautomatic loading feature of the standard friction feed roller. You load the paper into the back until it stops (about an inch), then hit the Top-of-Form button, and the printhead automatically positions itself on the first printing line—just like the HR-35. An easily accessible impression control switch hides under the spring-latched hood and can be set for high, medium, or low, depending on the number of carbon copies you want.

Like the new Brother printers, the ComRiter IV has a red ribbon tape in addition to its black ribbon cartridge, and they are both interchangeable with the comparable Brother ribbons. Its boldface, correspondence quality, underlining, proportional spacing, subscript, and superscript print enhancements are identical to those offered by Brother. And, not surprisingly,



ComRiter IV

Comrex International, Inc.
3701 Skypark Dr., #120
Torrance, CA 90505
(213) 373-0280
List Price: \$1,225

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using the Power On Default feature(s).
using the double print set feature(s).
using the bold print set feature(s).
using the shadow print set feature(s).

the daisywheels are identical, too.

I could not distinguish any difference in type quality between the ComRiter IV and the HR-35, and their print speeds were nearly the same as well: 32 cps in draft mode; 10 cps in correspondence quality or boldface for the ComRiter IV. If you're looking for excellent letter quality printing at average speeds, you should compare the HR-35 and the ComRiter IV before buying either one. The HR-35 is slightly quieter, but that's the only difference I could discern. —Phil Wiswell

Amdek 5040

The Amdek 5040 and I got off to a bad start, and that's a shame because I have a hunch this printer deserves a considerably better rating than I can give it. The 5040 didn't come out of the box smiling and ready to work. Normally I could manage to overlook this lack of readiness. But when I called Amdek for technical support and got very little, my impression of this

sullen machine nose-dived.

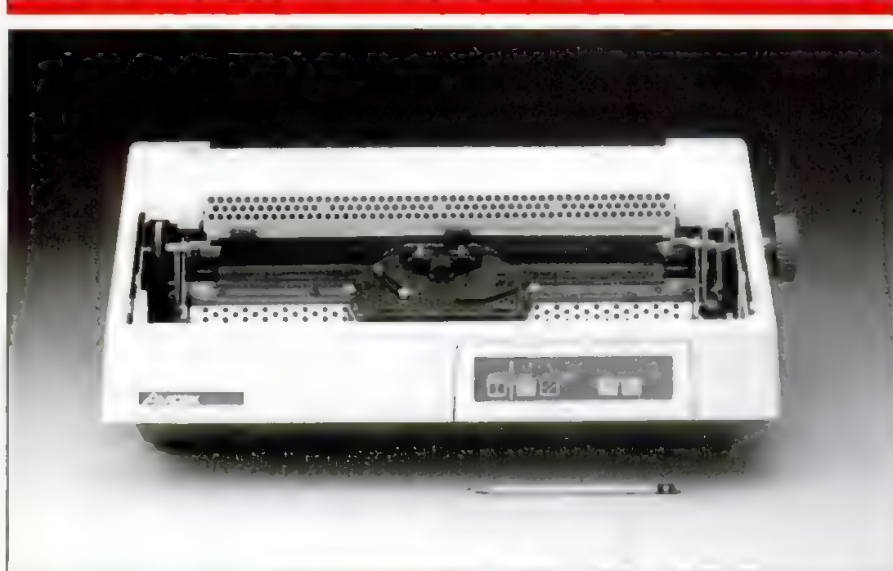
As near as I could determine, Amdek has a technical support force of one. If you call and ask for technical support, the company refers you to that person without even waiting to find out what product you're using.

Needless to say, the technical support person is very busy. When I called, he kept me on hold for over 15 minutes, much to AT&T's delight. When I finally broke through and was able to relate my problem, he perfunctorily decided that my

problem was in using the IBM-supplied cable rather than the interface cable supplied with the machine.

I assured him that our cable worked with just about everyone else's parallel ports, including at least one other made by Amdek. He, in turn, insisted that the pin-outs for the 5040 were different than those for the 5025 and that it would only work with the cable they had supplied. Unfortunately, by the time I had determined the speciousness of that logic he was off to handle someone else's problem. I quickly

When a printer doesn't work, who cares how highly it's rated? All that matters is what kind of support you can get from the manufacturer.



determined the problem was not with the cable, or at least that it was only part of the problem.

Before calling Amdek again, I tried several other things, including attempting to communicate with the printer through its serial port. When I talked to the technical support person again, after about a half-hour on hold, I told what I had ruled out since our earlier conversation. At that point he concluded that the problem was due to a certain setting of the dual in-line package switch. It was, and with the switch set properly, our trusty old interface cable worked just as well as Amdek's.

Once the 5040 was set up and on line, it pretty much did all the things it was supposed to do, as is true with many other printers in its class. I know from experience, however, that getting technical support for several comparable machines is much less painful.

When a printer or any other device doesn't work, it isn't important how "good" or highly rated that product is. All that really matters is what kind of support you can find to get it up and running again. And the Amdek 5040 flunked that test. If those of us at *PC* can't get the manufacturer's attention when we're evaluating its products, what chance does the average user have?—Jim Forney

Wq



5040
Amdek Corp.
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		Type	Price	Country	Dimensions (mm)	Weight (g)	CPS	Effective CPS	
NEC Information Systems	Spinwriter 2050	Thimble	\$1,200	Japan	6.1x21.4x14.5	26.4	23	21.4	13.4
Comrex International, Inc.	ComRiter IV	Daisywheel	\$1,225	Japan	7.7x21.2x15.2	32.2	23	32.5	10.0
Brother International Corp.	HR-35	Daisywheel	\$1,245	Japan	7.6x21.2x15.2	32.2	32	32.5	9.7
Silver-Reed	EXP-770	Daisywheel	\$1,295	Japan	7.8x22.9x14.9	30.9	31	33.8	15.8
Ricoh	I500Q	Daisywheel	\$1,489	Japan	8.3x24.0x15.2	39.6	40	37.1	13.8
Computers International	Daisywriter 2000	Daisywheel	\$1,495	Japan	6.7x23.8x14.7	35.0	40	20.0	6.4
Fujitsu America	SP320	Daisywheel	\$1,499	Japan	6.3x21.7x15.0	33.0	48	40.6	N/A
Amdek Corp.	5040	Daisywheel	\$1,499	Japan	8.3x24.4x15.2	39.6	40	36.3	14.2
Diablo Systems, Inc.	Series 36	Daisywheel	\$1,595	USA	9.8x24.6x15.9	50.0	35	26.3	N/A
TeleVideo	TP 750	Daisywheel	\$1,595	USA	6.0x22.5x16.0	35.0	50	42.1	N/A
Daisy Systems Holland	M45	Daisywheel	\$1,695	Holland	7.5x24.0x13.5	39.6	45	42.6	N/A
C. Itoh	Starwriter F10-40	Daisywheel	\$1,795	Japan	6.0x22.5x15.9	30.8	40	34.1	N/A
Daisy Systems Holland	M45 Quiet Write	Daisywheel	\$1,845	Holland	7.5x24.0x13.5	39.6	45	37.1	N/A
Primages, Inc.	Image I	Daisywheel	\$1,875	Taiwan	7.4x24.5x15.5	53.0	45	43.2	N/A
Intek	Sellum Pro 3500Q	Thimble	\$1,995	Japan/USA	9.0x24.0x15.6	37.4	33	29.7	19.3
C. Itoh	Printmaster F10-55	Daisywheel	\$1,995	Japan	6.0x22.5x15.9	30.8	55	44.8	N/A

Paper Feed: UT - Unidirectional tractor, BT - Bidirectional tractor, RSS - Roller, single sheet, RSF - Roller, sheet feeder, PFR - Pin-feed roller, RP - Roll paper **Paper Source:** F - Front, R - Rear, B - Bottom **Printing Features:** H - Horizontal emphasis, V - Vertical emphasis, C - Correspondence quality (matrix), U - Underline, S - Sub Superscript, R - Red ribbon **Formatting Features:** P - Proportional spacing, J - Justified lines, C - Centered lines, LH - Variable line heights, FL - Variable form length, HT - Horizontal tabs, VT - Vertical tabs **Smallest Horiz. Increment:** If printer has proportional spacing, N/A - Information not available **Smallest Vertical Increment:** N/A - Not available **Alternate Characters:** FL - Foreign language, DL - Download characters

	Rated DBA	Measured DBA	DBC	Font Type	Line Source	Carriage Return	Type Pitches	Printing Features	Formatting Features	Smallest Horizontal Increment	Smallest Vertical Increment
Shadow	58.0	76.0	75.0	RSS	R	16.0	10,12,15	H,V,U,S	P,J,C,LH, FL,HT,VT	1/120	1/48
Boldface	65.0	74.0	73.0	UT(O), RSS, RSF(O)	R	15.0	10,12,15	H,U,S,R	P,LH,FL, HT,VT	1/120	1/48
Doubleprint, shadow	65.0	74.0	73.0	UT(O), RSS, RSF(O), RP(O)	R	15.0	10,12,15	H,U,S,R	P,LH,FL, HT,VT	1/120	1/48
Double strike, bold	65.0	78.0	77.0	BT(O), RSS	R	13.0	10,12,15	H,U,S	P,J,C,LH, FL,HT,VT	1/120	1/48
Shadow	50.0	68.0	72.0	UT(O), RSS	R	15.0	10,12,15	H,U,S	P,LH,FL, HT,VT	1/120	1/48
Boldface	N/A	78.0	77.0	BT,RSS, RSF(O)	R	15.0	10,12,15	H,U,S	P,J,FL,HT, VT	1/120	N/A
N/A	59.0	N/A	N/A	BT(O), RSS, RSF(O), PFR(O)	R	16.0	5,8,5,10,12, 15	H,U,S,R	P,J,C,LH, FL,HT,VT	1/120	1/48
Boldface	N/A	69.0	70.0	UT(O), RSS	R	15.0	10,12,15	H,U,S	P,LH,FL, HT,VT	1/120	1/48
N/A	N/A	78.0	79.0	BT(O), RSS, RSF(O)	R	15.0	10,12,15	H,U,S	P,C,LH, FL,HT,VT	1/120	1/48
N/A	60.0	78.0	77.0	BT(O), RSS, RSF(O)	R	15.0	10,12,15	S	P(O),J(O), C(O),LH, FL,HT,VT	N/A	1/48
N/A	62.0	78.0	79.0	RSS	R	15.0	10,12,15	—	P,LH,FL, HT,VT	1/120	1/48
N/A	65.0	78.0	77.0	BT(O), RSS, PFR(O)	R,B	15.0	10,12	H,U,S	LH,FL, HT,VT	N/A	1/48
N/A	62.0	69.0	70.0	BT(O), RSS, RSF(O)	R	15.0	10,12	H,V,U,S	P	N/A	N/A
N/A	N/A	80.0	81.0	RSS, RSF(O)	R	15.0	10,12,15	H,U,S	P,FL,HT, VT	1/120	N/A
Boldface	60.0	78.0	77.0	UT(O), RSS	R	15.0	5,8,5,10, 12,15	H,U,S,R	P,J,C,LH, FL,HT,VT	1/120	1/48
N/A	65.0	78.0	78.0	BT(O), RSS, PFR(O)	R,B	15.0	10,12	H,U,S	P,LH,FL, HT,VT	1/120	1/48

AF=Alternate fonts, AC=Alternate character set(s) IBM PC Compatibility: L=Low-order characters, H=High-order characters, C=IBM PC Graphics Printer command sequences Graphics Compatibility: D=PC-DOS graphics command compatible, (3.0) DOS 3.0 required, G=Incompatible graphics, V=Vendor supplied software for compatible graphics Ribbon or Refill Type: S=Spool, C=Cartridge, CL=Cloth, CA=Carbon, I=Ink jet retil, T=Thermal paper Front Panel Controls: O=On/Off line, F=Form feed, L=Line feed, FL=Combined form and line feed, E=Error message and correction; P=Power-on settings # Mixable Colors: MP=Multiple passes produce combinations Ribbon Colors: A=Process, B=Process or primary (O)=Optional

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Manufacturer	Model	IBM PC Compatibility	Other Printers Compatible	Buffer Size (Bytes)	Ribbon Type or Refill	Ribbon or Refill Cost	Front Panel Controls
NEC Information Systems	Spinwriter 2050	L,H	—	2,048	C,CL,CA	\$7.12	O,L,F,P
Comrex International, Inc.	ComRiter IV	L	Diablo	5,000	C,CL,CA	\$5.00	O,L,F,E,P
Brother International Corp.	HR-35	L	—	7,000	C,CL	\$5.85	O,L,F,P
Silver-Reed	EXP-770	L	Diablo 630	2,048	C,CL,CA	\$8.00	O,L,F
Ricoh	1500Q	L	—	2,048	C,CL	N/A	L,F,E
Computers International	Daisywriter 2000	L	NEC, Diablo, Qume	49,152	C,CA	N/A	O,L,F,P
Fujitsu America	SP320	L	Diablo 630	3,072	C,CL,CA	N/A	O,L,F,E,P
Amdek Corp.	5040	L	—	2,048	C,CL	N/A	L,F,E
Diablo Systems, Inc.	Series 36	L	Diablo 630	1,280	C,CA	N/A	L,F,E,P
TeleVideo	TP 750	L	Diablo 630	1,560	C,CL	\$6.00	O,L,F,E,P
Daisy Systems Holland	M45	L	—	512	C,CL	\$7.20	L,F,E
C. Itoh	Starwriter F10-40	L	—	0, 2,048(O)	C,CL	\$5.50	O,L,F,P
Daisy Systems Holland	M45 Quiet Write	L	—	1,536	C,CL,CA	N/A	O,L,F,E,P
Primages, Inc.	Image I	L	—	0	C,CL,CA	\$7.95	O,L,F,E,P
Intek	Sellum Pro 3500Q	L	Diablo, IBM, Epson, NEC, Qume	49,152	C,CL,CA	\$7.12	O,F,E,P
C. Itoh	Printmaster F10-55	L	—	0, 2,048(O)	C,CL	\$5.50	O,L,F,E,P

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary (O)=Optional.

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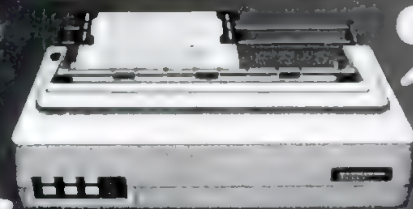
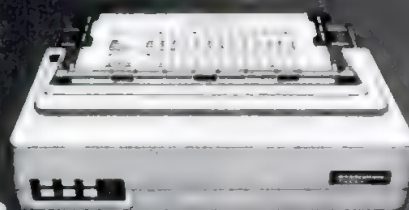
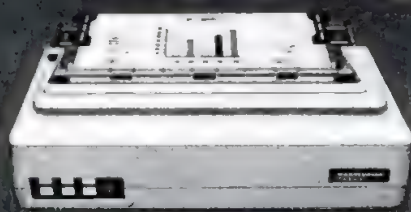
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Qume Sprint 11/55 Plus

Finally! I found a printer I like. I mean *one I really like*. It's the Qume Sprint 11/55 Plus, made here in the U.S.A. by a subsidiary of ITT. At \$2,295 it's not necessarily the perfect companion for a home PC, but this little baby sure can make the paper fly in an office environment. And its price tag makes it a good competitor in the

letter quality printer market. The 55 in its name represents the number of characters per second that its daisywheel produces. In our test it averaged within 1 cps of that speed.

One of the Sprint's interesting features is its interchangeable interfaces. The printer comes with just a socket for a card edge connector, located in an opening in the back of the machine. Since the printer arrived without an interface, we had to delay our test until Qume could send us one. It was a cinch to install. Just slide it

into place and plug the attached cable into your computer. About 5 minutes after you start to unpack the printer, the Sprint should be sprinting.

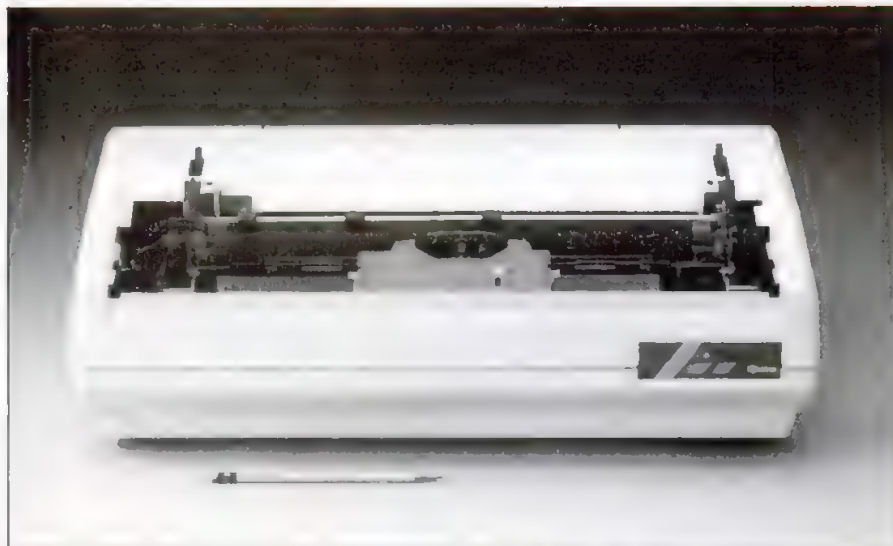
This isn't one of those speedy machines that do nothing much but do it fast. The print was crisp and clean. And if you want enhancements, it comes with the features you'd expect from a fully formed character printer.

In fact, the Sprint has something extra that you don't see very often: You can specify the heaviness of boldface type. The printer will execute either two or three strikes, depending on the number you enter as part of the escape sequence. And this feature is also clearly documented—another plus.

The Sprint doesn't come with a tractor, but you can add a bidirectional one to handle forms up to 15 inches wide. Also available is a cut-sheet feeder that will not only feed but collect as many as 200 sheets of 20-pound paper. It handles sheets up to 12 inches wide by 14 inches long. Even with its fast speed, the printer should stay busy for quite a while without someone's having to baby-sit.

If the Sprint falls a little short, it's in styling. Not that there's anything wrong with its appearance. It's just that I had the feeling it could get lost in a crowd of three. But then you don't buy a machine like this to complement the Ming vase you wish you could afford.

I'll say it again: I really like this one. And now you'll have to excuse me. I've got a letter to write . . . anyone know Santa's ZIP code? —**Jim Forney**



Wq

Sprint 11/55 Plus

Qume
2350 Qume Dr.
San Jose, CA 95131
(408) 942-4000
List Price: \$2,295

CIRCLE 709 ON READER SERVICE CARD

using the Power On Default feature(s).

IBM 5218

Many adjectives come to mind for describing the IBM 5218 printer, but the first has to be "large." The 5218 consists of two main assemblies: the printer itself and a unique, three-size paper sheet feeder mechanism that is larger than the printer it rests on.

First, the printer: This IBM 5218 is a

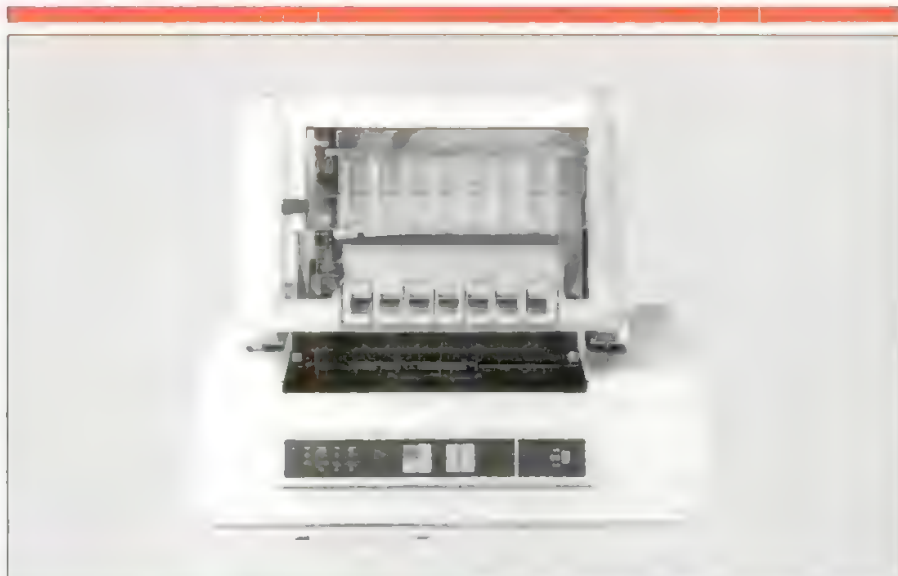
versatile machine. Besides being one of the fastest daisywheel printers tested for this project, it was also one of the most quiet. Just by looking at it, you can tell that this machine was designed for the office environment. The paper-feed mechanism is one example: the operator merely inserts a sheet of paper through a slot in the top of the printer, presses a load button, and after much mechanical whirring and clicking, the paper is properly positioned for printing.

One word of warning—the 5218 printer was originally designed for use with the IBM Displaywriter word processor. That means that this printer's only interface to the outside world is a 20-milliampere current loop circuit—something that may be hard to come by on a PC. Actually, the PC-XT's async card will handle the job nicely if it's properly configured, but I checked around for add-on multifunction boards that included this interface and found none. (As it turns out, the Displaywriter connection is a blessing when you are using the 5218 with IBM's new *DisplayWrite 2* word processing package on the PC.)

The paper feeder attachment is the second piece of the IBM 5218 package. It sits atop the printer, and its mechanical connection makes it very simple to install and remove. The feeder contains two paper trays, which are adjustable to most sizes of stationery, as well as a third bin on top to hold envelopes. You can use the software to control the type of stock to print on. This was one of the most reliable feeders found on the printers tested for PC, and it seems to be ideal for large office printing needs.

When you purchase the 5218 for use with a PC, you get a kit containing several necessary items: a printer cable, a disk, and a manual describing the programs on the disk. The programs modify PC-DOS so that it will accommodate the serial driver as the main printer port and map the PC's character codes to those of the 5218.

I found one quirk in the software—



Wq

5218

IBM Entry Systems Division
P.O. Box 1328
Boca Raton, FL 33432
(305) 998-2000
List Price: \$3,680

CIRCLE 689 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Special Emphasis feature(s).
using the Proportional Spacing feature(s).
using the Subscript feature(s).

PC's test programs were written using the IBM BASIC Compiler, and for some reason this program did not recognize the existence of the printer. A couple of telephone calls to IBM got to the root of the problem—you must either have another printer card installed in the machine or POKE to a location in low memory in order to fool BASIC into thinking that there is another printer present. This awkward procedure could be frustrating for the casual, uninitiated user, but IBM claims that its dealers will be able to steer their

customers in the right direction. The 5218 worked absolutely fine with all the other software tested.

Although we did not have an opportunity to test it, IBM also offers a printer-sharing device for use with the 5218. This allows four users to simultaneously access the printer. Given its high price, such an attachment might go a long way toward making the printer more cost effective. The 5218 is, in any case, an ideal PC printer for heavy-duty office jobs.

—Bill Harts

NEC Spinwriter 3550

The NEC Spinwriter 3550 printer reminds me of my favorite pair of blue jeans—functional, comfortable, but not very snazzy. The technology behind this daisywheel machine is a few years old, so while NEC might not sport the latest electronic and mechanical enhancements, it's definitely a time-tested "industry stan-

dard." But NEC's new line of industrial-strength printers promises to jazz up the Spinwriter with faster speeds, increased user friendliness, and easier maintenance and repair. And, since Big Blue backs the Spinwriter by prominently displaying it at IBM Product Centers, you can bet that it's likely to wear well.

The Spinwriter 3550 is a parallel interface printer that produces superior letter quality print. Its documentation has an even, orderly, pleasant cadence. And for those who require a security blanket, the

Spinwriter 3550's lengthy appendix details installation instructions for many IBM-compatible software packages. Knowing the manufacturer has actually tried to configure *WordStar*, *MultiMate*, and other classics conjures a warm feeling of calm and ease.

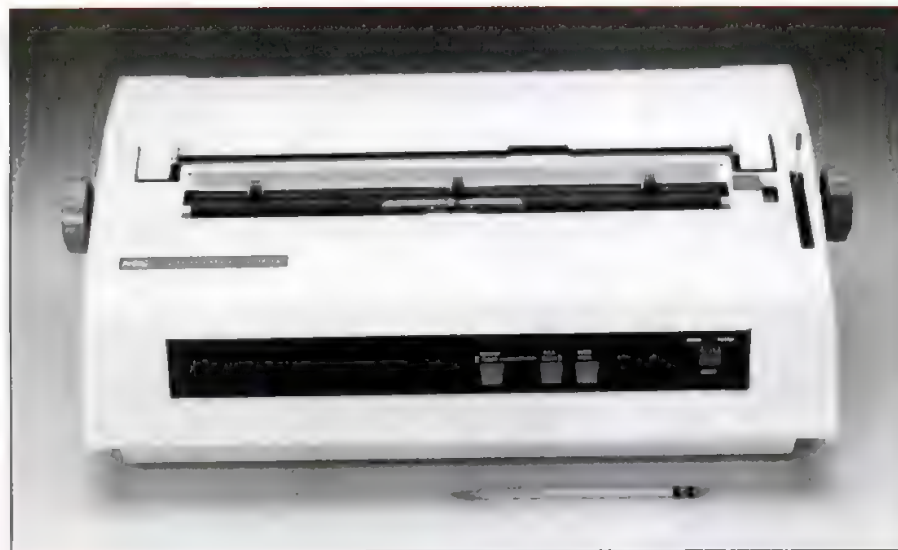
The Spinwriter was easy to set up and felt solid and reliable. It cranked out text at a respectable 30 cps with a tolerable 60 db noise level. The printer comes with a variety of cloth and multistrike ribbons (it allows for red ribbons) and an absolutely IBM-compatible character set. Since my review machine came outfitted with only a Courier 72 print thimble, I couldn't investigate the graphics and proportional spacing capabilities, which are available only with special thimbles.

The 3550 can print bidirectionally in 10, 12, or 15 pitch. It features underlining, double strike, double spacing, and shadow print. You can adjust line spacings as well as horizontal and vertical resolutions. Only the emphasized "shadow" didn't live up to my expectations. The characters lost much of their default crispness.

If you deal with customized forms, you'll adore this machine. The Spinwriter 3550 can accommodate as many different types of forms as the IRS. There's a Bottom Feed Guide, a Demand Document Feeder, a Front Inserter, Bi- and Uni-Tractor Feeds, and more. Surprisingly, NEC's generally excellent documentation neglected to discuss any of these optional contraptions, so I was left to my own mechanical aptitude to perfect the operation. Subsequently my tractor form never fed paper quite correctly.

The only thing that the NEC Spinwriter 3550 has more of than form feeders is print thimbles. It accepts well over 50 print thimbles, including graphic characters, Arabic, OCR, and italics. It sounds like a font maniac's paradise, but some of the more exotic print thimbles may not be widely available.

Recognizing that life and death continue after 90 days, NEC offers an extended service contract on its machines. Of



Wq

using the Power On Default feature(s).



Spinwriter 3550

NEC Information Systems, Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000

List Price: \$2,290

CIRCLE 794 ON READER SERVICE CARD

course, quality print, a reputable name, and a service organization aren't free. NEC's Spinwriter 3550 lists for \$2,290—not cheap for a printer that isn't industrial strength or state of the art.

—Robin Raskin

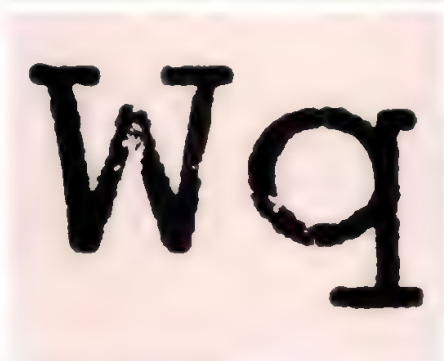
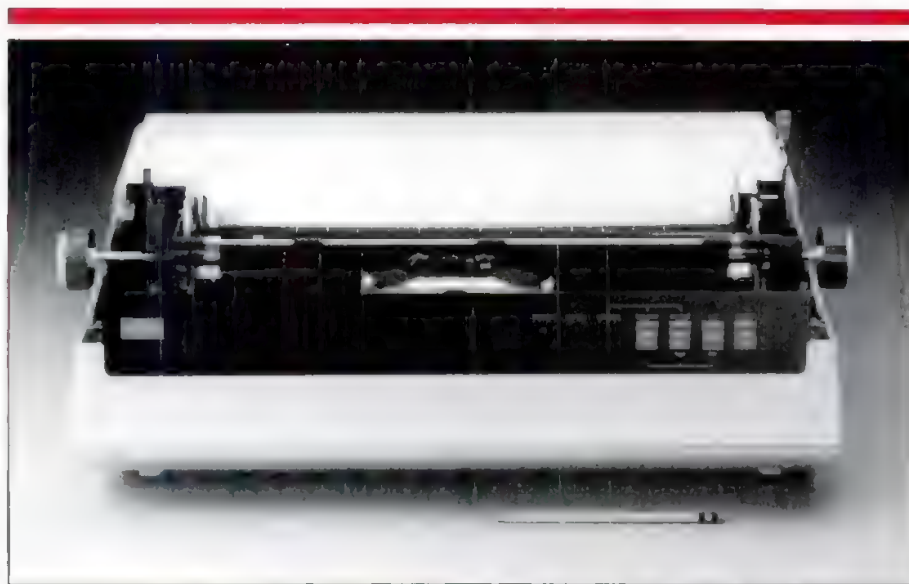
Fujitsu SP830

Odds are that Fujitsu is not a name that springs to mind when you think about printers, but, judging by the SP830, perhaps it ought to be. This is not an unqualified recommendation (for reasons that will soon be clear), but the SP830 is an impressive printer. If Fujitsu can smooth out some wrinkles in supporting it, they just might wind up with a winner.

The support problems begin when you take the printer out of the box. The manual that came with our test unit was clearly labeled as the *SP830 Operator's Guide*, but it had nothing to do with the printer. One example: While the printer's control panel had two sets of eight DIP switches, the manual showed a control panel with three banks of DIP switches plus additional controls for column space, line space, and form length, none of which matched anything that was actually on the SP830 printer.

Of course, such inconsistencies only serve to confuse anyone not already familiar with the machine. It also doesn't help matters that the model number appears nowhere on the machine—except on the serial-number plate, where it is given as 3313A2, which left me wondering if Fujitsu had simply sent us the wrong printer.

A phone call to the company cleared up the problem. It turned out that there are three different manuals for the SP830: one for the serial version of the machine, one for the parallel version, and the one Fujitsu sent us, which is for "the special control panel configuration." This is apparently standard operating procedure, since Fujitsu sent us two SP830s, and both had the same incorrect manual. I asked about this and was told that it isn't generally a prob-



using the Power On Default feature(s).

SP830

Fujitsu America
3055 Orchard Dr.
San José, CA 95134
(408) 946-8777

List Price: \$2,995

CIRCLE 696 ON READER SERVICE CARD

lem because most of the printers go to OEMs who are already familiar with the machine. Draw your own conclusions.

Incidentally, a not-so-minor complication if you get the wrong manual is that the serial version of the machine follows the Diablo 630 control codes, while the parallel version follows the Qume Sprint 5 control codes. It might also be helpful to know that the control codes for the printer are *not* in the operator's manual, but in the booklet labeled *SP830 Interface Specifications*.

Once you get the SP830 working, you might almost forgive Fujitsu for making the setup harder than it has to be. Everyone at *PC* who saw this printer in operation was impressed by its speed and low noise level. The speed was tested at 63.9 cps, which puts it way ahead of most daisywheel printers. Also worth noting is that Fujitsu is planning a new version, the SP830 CA, that will be switch selectable in order to follow either the Diablo 630 control codes or the Qume Sprint 11 control codes.

(continued)

The question, of course, is whether the SP830 is worth considering. The answer is a definite maybe. If you are sufficiently experienced with printers to be able to deal with the lack of information, it may be worth it. If you have a good dealer who can provide support when Fujitsu fumbles the ball, you may not notice a problem. And if Fujitsu recognizes that it has a problem with support and decides to do something about it, then you may indeed want to take a careful look at this printer. I certainly would. —M. David Stone

Diablo 630 ECS

When *PC Magazine* asked me to review the Diablo 630 ECS, I jumped at the chance because I have owned a Diablo 630 for 4 years and have always been happy with it.

As a professional writer, the Selectric-quality output of the Diablo 630 is important to me—as is the machine's ruggedness and its reputation as a workhorse.

There have been days when my 630 has sat idle, but there have also been days when it has obediently pounded out four copies of a 400-page manuscript without creaking, complaining, or stopping for breath. Although I maintain a service contract on the printer, I have yet to use it.

The 630 ECS is an improvement on the Model 630. ECS is short for extended character set. As the name implies, the 630 ECS can print the IBM PC's high-order characters as well as the standard alphanumeric ones. To the best of my knowledge, it is the only daisywheel printer that handles this type of printing, and there are times when I could certainly make use of it.

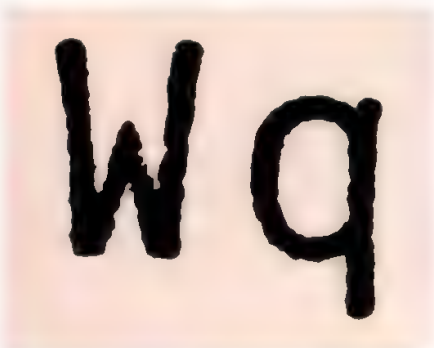
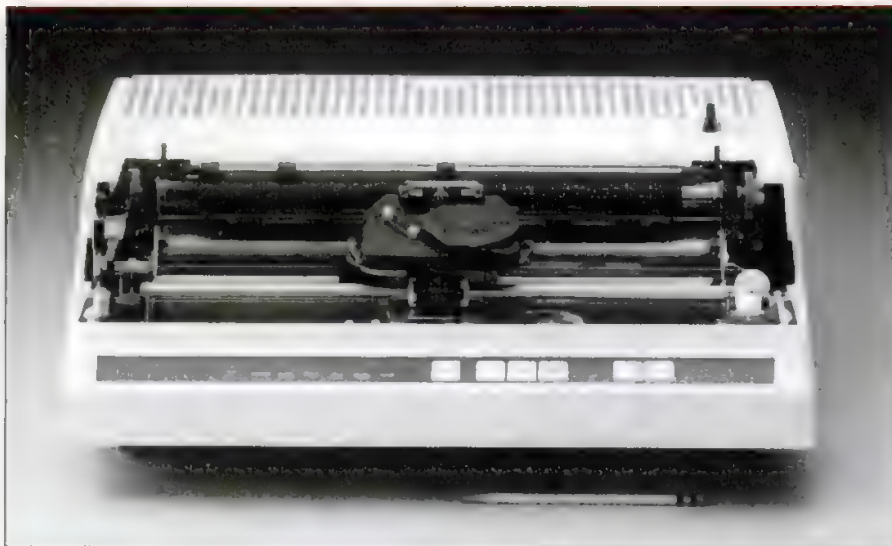
Normal Diablo printers use printwheels with a maximum of 96 spokes; so coaxing the 630 ECS printer into producing all 192 characters in the IBM PC's "vocabulary" is no mean feat.

The trick is accomplished by putting two characters on each spoke of the printwheel. The low-order characters are on the tip of each spoke, where you would normally expect to find them, and the high-order characters are about halfway down the spokes. When the 630 ECS is printing, it not only spins the wheel to the proper position but shifts the wheel up and down as necessary. I don't even want to think about the engineering involved in getting all this to work properly, but it works and works well.

The printer does slow down while it's printing the extended character set. Diablo claims that the 630 ECS does 40 cps with low-order characters only or 32 cps with the ECS characters. We didn't run a separate speed test for the ECS characters, but in our standard speed test the printer did just under 39 cps, very close to Diablo's rating. It's a good bet that the 32-cps rating is also close to reality.

One limitation: Only one printwheel that contains the full ECS character set is available. The printer can also use standard Diablo and Qume printwheels, but you lose the high-order characters.

The 630 ECS has an optional All Pur-



630 ECS
Diablo Systems, Inc.
P.O. Box 5030
Fremont, CA 94537
(415) 498-7000
List Price: \$2,595

CIRCLE 684 ON READER SERVICE CARD

using the Power On Default feature(s).

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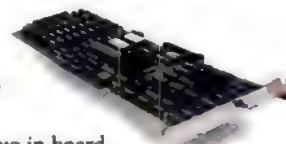
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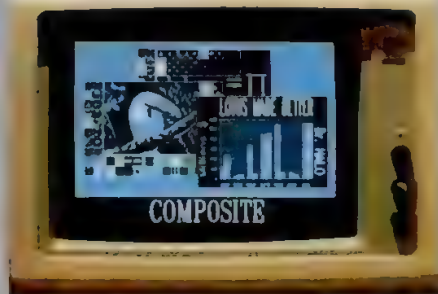
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NEC Information Systems	Spinwriter 3550	Thimble	\$2,290	Japan	9.0x24.0x15.6	37.4	33	29.8	30.0
Qume	Sprint 11 55 Plus	Daisywheel	\$2,295	USA	6.6x23.2x13.3	37.0	55	53.9	35.9
Diablo Systems, Inc.	630 ECS	Daisywheel	\$2,595	USA	9.75x23.1x18.5	60.0	40	38.7	N/A
Fujitsu America	SP830	Daisywheel	\$2,995	Japan	7.3x23.5x17.9	39.6	80	63.9	N/A
IBM	5218	Daisywheel	\$3,680	USA	8.0x26.0x23.0	58.4	60	44.8	N/A

Paper Feed: UT=Unidirectional tractor, BT=Bidirectional tractor, RSS=Roller, single sheet, RSF=Roller, sheet feeder, PFR=Pin-feed roller, RP=Roll paper. **Paper Source:** F=Front, R=Rear. **B=Bottom**. **Printing Features:** H=Horizontal emphasis, V=Vertical emphasis, C=Correspondence quality (matrix), U=Underline, S=Sub/Superscript, R=Red ribbon. **Formatting Features:** P=Proportional spacing, J=Justified lines, C=Centered lines, LH=Variable line heights, FL=Variable form length, HT=Horizontal tabs, VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language, DL=Download characters.

pose Interface that is compatible with IEEE, RS-232, and Centronics. There are no DIP switches to set, but it is important to make sure you have the right cable for your needs. The Diablo cables come with small plastic tags indicating the computer they are meant to connect with. These tags are exceedingly easy to overlook.

The only problems with this printer are its poorly organized manual and inadequate support from the manufacturers. Setting up the 630 ECS is actually a straightforward procedure, but there is no way to tell that from the manual. The 630 ECS is not alone in having this problem, but Diablo manages to compound the problem with a lack of support. Several reviewers on this project found it nearly impossible to get through to Diablo's technical-support number. And when we did get through, we reached an answering machine that didn't take messages.

In desperation, we started calling other Diablo numbers, mostly without results. I even called the marketing department, announced that I was calling from PC, and explained that I was reviewing the printer and needed some information. The woman who answered tried referring me back to technical support. When I pointed out that I was calling her because technical support was no help, she promised she would get the needed information and call me back. I'm still waiting.

Most of the help I got came not from Diablo but from local Xerox service centers and retail stores. It's not clear why there should be this differentiation, but the people I spoke to at Xerox were much more helpful than the people at Diablo. One technician at a Xerox service center even complained that technical support at Diablo isn't good.

All of which leads me to give a lukewarm recommendation. The 630 ECS is a

good machine; there's no doubt about that. The support offered by local Xerox service centers is also good, in my experience at least. Yet Diablo itself doesn't seem to care about support, and that is worrisome. If you run into a problem that your local dealer or service center can't help you with, you may well find yourself up the well-known creek; and Diablo apparently doesn't want to be bothered with handing out paddles.—M. David Stone

FULLY FORMED OVERVIEW • M. DAVID STONE

MAKING A GOOD IMPRESSION

We tested just under 40 daisywheel and thimble printers for this issue, not an overwhelming number, but enough to make most of these printers merge into a faceless crowd. A handful of them did manage to stand out, however. Since differences in print quali-

ty among the daisywheel and thimble printers are usually trivial, we looked at speed, cost, reliability, support, features, availability of print elements, and compatibility with IBM PC hardware and software. We first divided printers into categories by cost, then compared them using

	Rated DBA	Measured DBA	DBC	Paper Feed		Width (inches)	Type Pitches	Printing	Formatting	Smallest Character	Smallest Spacing
Shadow print	60.0	78.0	79.0	UT,BT(O), RSS, RSF(O)	R	15.0	5,8,5,10, 12,15	H,U,S,R	P,J,C,LH, FL,HT,VT	1/120	1/48
Boldface	63.0	78.0	77.0	UT(O), RSS, RSF(O)	R	15.0	10,12,15	H,U,S	P,LH,FL, HT,VT	1/120	1/48
N/A	N/A	73.0	72.5	BT(O), RSS, RSF(O)	R	16.0	10,12,15	H,U,S	P,LH,FL, HT,VT	1/120	1/48
N/A	N/A	71.0	70.0	BT(O), RSS, RSF(O)	R,B	15.0	5,8,5,10, 12,15	S,R	P,J,C,LH, FL,HT,VT	1/120	1/96
N/A	N/A	72.0	73.0	RSS, RSF(O)	R	15.0	10,12,15	H,U,S,R	P,LH,FL, HT,VT	N/A	1/8

AF=Alternate fonts, AC=Alternate character set(s) IBM PC Compatibility: L=Low-order characters, H=High order characters, C=IBM PC Graphics Printer command sequences Graphics Compatibility: D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required, G=Incompatible graphics, V=Vendor-supplied software for compatible graphics Ribbon or Refill Type: S=Spool, C=Cartridge, CL=Cloth, CA=Carbon, I=Ink jet refill, T=Thermal paper Front Panel Controls: O=On/Off line, F=Form feed, L=Line feed, FL=Combined form and line feed, E=Error message and correction, P=Power-on settings, # Mixable Colors: MP=Multiple passes produce combinations, Ribbon Colors: A=Process; B=Process or primary, (O)=Optional

the other criteria.

Here are the few printers that stand out as best buys, listed by price category.

UNDER \$1,000

As little as 3 years ago, \$1,500 was about the least you could expect to pay for a daisywheel printer. That price makes \$1,000 or less seem like a bargain.

The printers in this category typically have default speeds of 10 to 25 characters per second as measured on our tests. Most run at under 20 cps. Keep in mind that these printers produce Selectric-quality print and that print enhancements are generally reserved for special effects, not for improving readability. Typical enhancements include boldface and underlining. Superscripts and subscripts are available in more than half the printers we tested.

Machines in the budget category are appropriate only for light use—primarily because of their speed limitations. If you already have a dot matrix printer as your workhorse and want to occasionally send letters or print short reports with a Selectric-quality printer, then a budget daisywheel printer may be all you'll need. Don't expect to print hundreds of form letters at a time, however.

Silver-Reed EXP-400

At \$399 list (discounted to under

\$300), the EXP-400 was the least expensive daisywheel printer we tested. In fact it was only four dollars more than Electric Typing Fingers, a gadget that lets you use your typewriter as a printer. I've always thought of Electric Typing Fingers as a last resort for people who can't afford a printer. With the EXP-400 on the scene, the low-budget last resort has now become obsolete.

Price is only part of the good news. More important is that the EXP-400 is a credible machine that includes such frills as incremental spacing and built-in boldface and underlining. Our reviewer found some "minor annoyances"—deficiencies that apparently grow out of cost-conscious corner cutting—but whatever minor things are wrong with this machine are far outweighed by its good points. One point especially worth noting is the easy availability of print wheels and ribbons.

The EXP-400 is not a heavy-duty printer by any stretch of the imagination, and it will never win any speed tests. But it will happily stroll along at just under 12 cps, sounding like a fast typist and producing Selectric-quality output. If your needs are similarly modest, don't pass this one up.

Dynax DX-15

For \$499, the Dynax DX-15 daisywheel is a lot of printer. In fact, it has so

many goodies on it that I hardly know where to begin. It gives you such features as boldface, underlining, superscript and subscript, incremental spacing, and variable line height. It adds red ribbon printing along with black and throws in an optional keyboard that will let you use the printer as a typewriter. Both cloth and carbon ribbon cartridges are available in a variety of colors, and it offers more than 20 different daisywheel type styles to choose from. And it uses the same control codes as the Diablo 630, so most software supports it without special installation procedures.

Designing such a printer to sell for \$499 is a pretty remarkable feat, but Dynax didn't perform it. A Dynax DX-15 by any other name would be a Brother HR-15. In fact, Brother seems intent on confusing us all by hanging other manufacturers' names on the outside of its printers. Brother, no doubt, is making a bit of pocket money this way. But, considering the quality of its machines, it is certainly entitled to the extra profit.

Juki 6100

Our reviewer thought the Juki 6100 was an intriguing little printer, and we agree. It's fast, easy to set up, packed with features, and comes with a manual that's good enough to deserve praise—all for \$599.

(continued)

SPECIAL ISSUE • FULLY FORMED \$2000 AND UP

Manufacturer	Model	IBM PC Compatibility	Other Printer Compatible	Buffer Size (bytes)	Ribbon Type or Refill Type	Ribbon or Refill Cost	Front-Panel Controls
NEC Information Systems	Spinwriter 3550	L,H (with special thimble)	—	2,048	C,CL,CA	N/A	O,F,E,P
Qume	Sprint 11/55 Plus	L	—	500	C,CA	N/A	O,F,E
Diablo Systems, Inc.	630 ECS	L,H	Diablo 630	N/A	C,CL,CA	N/A	L,F,E,P
Fujitsu America	SP830	L	Diablo & Qume	2,048	C,CL,CA	N/A	O,L,F,E,P
IBM	5218	L	—	0	C,CL,CA	N/A	O,L,F,E,P

Paper Feed: UT—Unidirectional tractor; BT—Bidirectional tractor; RSS—Roller, single sheet; RSF—Roller, sheet feeder; PFR—Pin-feed roller; RP—Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H—Horizontal emphasis; V—Vertical emphasis; C—Correspondence quality (matrix); U—Underline; S—Sub-Superscript; R—Red ribbon. **Formatting Features:** P—Proportional spacing; J—Justified lines; C—Centered lines; LH—Variable line heights; FL—Variable form length; HT—Horizontal tabs; VT—Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A—Information not available. Otherwise, N/A—Not applicable. **Smallest Vertical Increment:** N/A—Not available. **Alternate Characters:** FL—Foreign language; DL—Download characters; AF—Alternate fonts; AC—Alternate character set(s). **IBM PC Compatibility:** L—Low-order characters; H—High-order characters; C—IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D—PC-DOS graphics command compatible; (3.0)—DOS 3.0 required; G—Incompatible graphics; V—Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S—Spool; C—Cartridge; CL—Cloth; CA—Carbon; I—Ink jet refill; T—Thermal paper. **Front Panel Controls:** O—On/Off line; F—Form feed; L—Line feed; FL—Combined form and line feed; E—Error message and correction; P—Power-on settings. **Mixable Colors:** MP—Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary; (O)=Optional.

Features on the 6100 include all the standard print enhancements, incremental spacing, and a built-in proportional spacing capability. Its most attractive feature is unquestionably its speed. At 20.3 characters per second, the Juki 6100 is one of the faster printers in its price class, easily outpacing at least one printer that costs \$400 more. The manual also rates as an important feature: good printer manuals are a lot harder to come by than good printers, and putting both in the same package is almost unheard of. Somehow, Juki managed to do it.

Unfortunately, the printer is not without problems. In addition to being one of the faster printers in its class, it's also one of the noisiest. In fact, it is one of the noisiest daisywheel or thimble printers we tested in any category—so loud that our reviewer concluded that you must listen to this printer before buying it. You might also consider getting a long cable and putting the noisy Juki 6100 in a closet—or in another room.

C. Itoh A10-20R

There is little to say about the C. Itoh A10-20R. It is a solid machine that gives you everything you would expect from a good daisywheel printer, including the standard print enhancements, incremental spacing, built-in proportional spacing, and variable line height, for \$795. And it

gives you all this at a measured speed of 23.9 characters per second. Though not fast enough for heavy-duty word processing, this is the second-fastest speed of any printer in this price class.

Perhaps most notable about the A10-20R is that we have no important reservations in recommending it. Its manual is, for the most part, useless, but that is par for the course. Everything else—print quality, sound level, availability of ribbons and printwheels—is acceptable or better. There is nothing particularly exciting about this printer, but nothing particularly frustrating about it either. If what you want is a reasonably competent machine for light duty or medium duty and Selectric-quality output, you can't afford to miss this one.

\$1,000 TO \$1,999

If your printing needs include serious, heavy-duty word processing output, you'll have to ignore the budget class and move into this mid-price range. Printers in this category typically run at speeds between 30 and 40 characters per second, although one printer (not an editor's choice) ran a slow 21 cps, and a handful came in at 40 to 45 cps. We found two clear winners in this category—one at the low end, one at the high end—and not much else worth bothering with.

Comrex ComRiter IV Brother HR-35

No, that double subhead is not a misprint. These two printers belong together, listed as a single entry. In fact, they appear to be a single printer masquerading under two names. The only distinction that our reviewer Phil could find was in the noise level: the ComRiter IV, at \$1,225, was the noisier of the two. It's not even clear whether this difference is real or is simply due to individual variation among machines. We measured identical noise levels when printing; the extra noise in the ComRiter IV came from a motor that insisted on whining for a few seconds after printing stopped.

As far as we can tell, Brother has again hung someone else's name on its machine. The difference in price—the Brother is \$1,245—seems irrelevant.

Both printers are worth looking at. We measured a speed of 32.5 characters per second—not the fastest in this category, but fast enough to qualify for serious word processing applications. Their features include all the standard print enhancements, incremental spacing, and built-in proportional spacing. They also have easy-to-use front panel controls instead of hidden, arcane DIP switches. The sleek modern design is also a welcome plus. You can find a better printer than this, but not without investing a whole lot more money.

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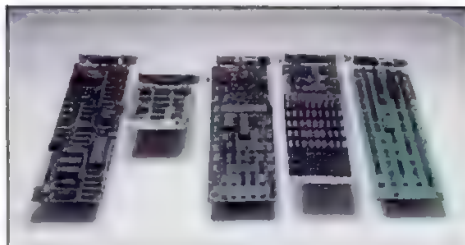
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Both the 5160 and the 6160 offer MS-DOS* and GW-Basic;* in addition, the 6160 factory system offers VRTX†, a multitasking kernel that permits you to run real-time, interrupt-driven control applications.

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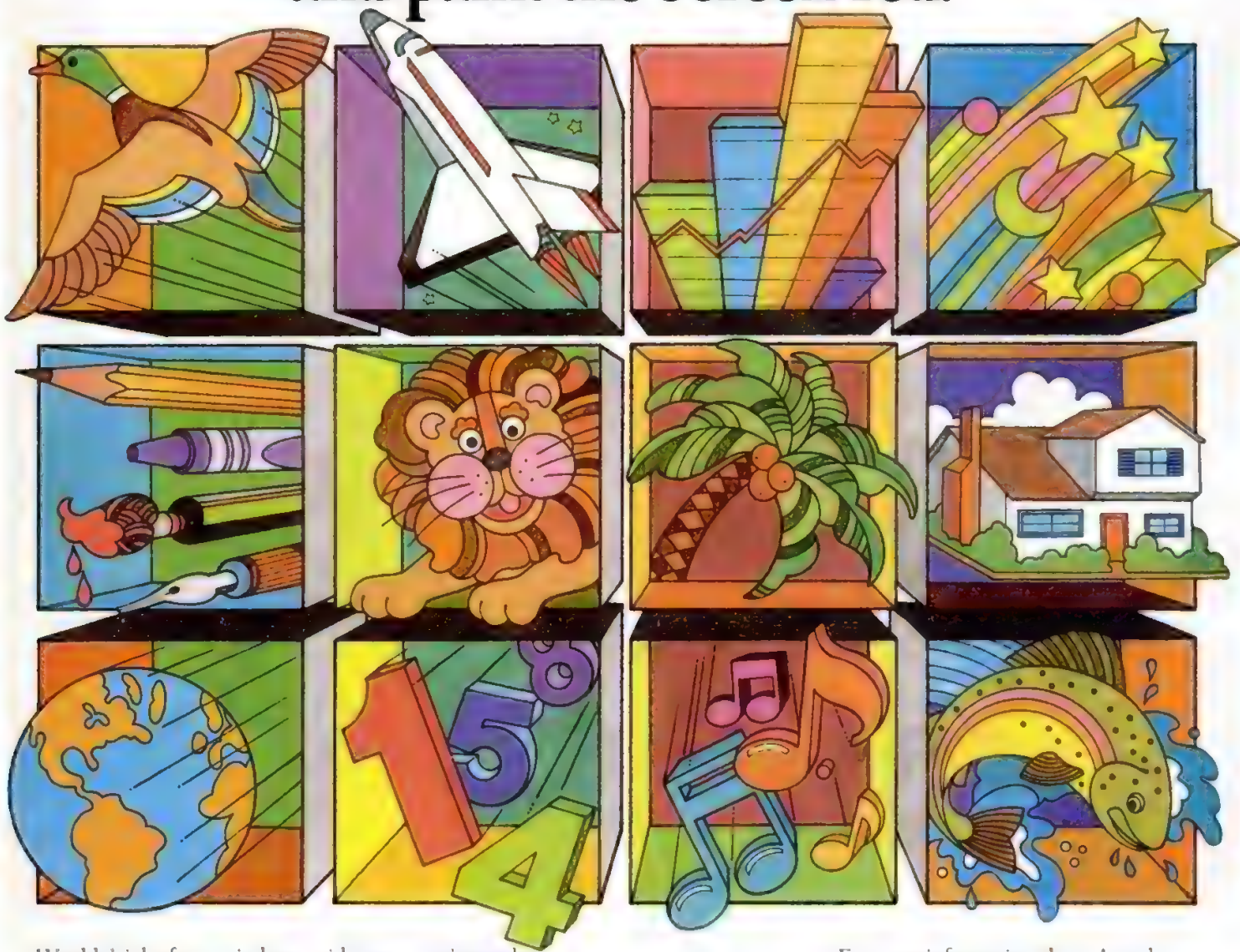
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CIRCLE 540 ON READER SERVICE CARD

Primages Image I

Easily the outstanding printer in its price category, the Image I, at \$1,875, has little competition unless you start comparing it to printers that cost \$2,000 or more. For a start, it clocks in at 43.2 characters per second. This speed isn't much when compared to dot matrix printers, but for a daisywheel, it's a pretty good clip. It certainly qualifies the Image I for serious word processing applications.

The Image has such other nice touches as both a parallel port and serial port. You may never need both, but it's nice to know they are there.

The one problem you may have with the Image I is noise. A glance through the charts will show you that this is the noisiest daisywheel or thimble printer that we tested. As we suggested with the Juki 6100, you should certainly listen to this printer before buying it. Once again, you might consider getting a long cable and putting the printer in a closet.

\$2,000 AND UP

In this rarefied price range, the number of printers drops considerably. We only found five printers to test in this category, and four of the five are worth at least a qualified recommendation.

Qume Sprint 11/55 Plus

We had a tough time tearing our reviewer away from the Qume Sprint 11/55 Plus, and for a good reason. This least-expensive of the high-priced printers (\$2,295) comes from a company that knows what it is doing. The "55" in the name stands for 55 characters per second. We tested it at an honest 53.9 cps, which still qualifies as racing-car speed for a daisywheel printer.

The Sprint 11/55 Plus was extraordinarily easy to set up and use. And, of course, it has all the standard print enhancements and other features you would expect from a daisywheel printer. Also worth noting is that the Sprint 11 control codes are as standard as printer codes get

in the industry, so many programs are written to control the Sprint 11 without special installation.

So, what are you waiting for? Call up

your dealer. This one is fast, heavy duty, and a prime choice for anyone who is serious about word processing with Selectric-quality output.

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CIRCLE 386 ON READER SERVICE CARD

Diablo 630 ECS

The Diablo 630 has earned a reputation as a real workhorse. The 630 ECS, for extended character set, has the added dis-

tingtion of being the only fully formed character printer on the market, daisy-wheel or otherwise, that can print the IBM's high-order characters—all for

\$2,595. Technical types can use it to print formulae with Greek letters and mathematical symbols that are otherwise unavailable on daisywheel printers. And everyone can use it to print text graphics.

The only real reservation about the 630 ECS is not with the machine, but with the support behind it. Diablo has repeatedly proved itself unable to provide support.

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CIRCLE 181 ON READER SERVICE CARD

Fujitsu SP830

The Fujitsu SP830 printer, at \$2,995, is both fast and quiet. When we started, we knew we had something special on our hands. We didn't know how special, though, until we ran the speed test and came up with a figure of 63.9 characters per second. This result makes the Fujitsu the fastest daisywheel printer we tested.

Our reservations about the Fujitsu have once again to do with support. The printer came with the wrong manual, and it took two days, two reviewers, and a second printer to figure out how to get it working. On the other hand, the company made a real effort to help solve the problem.

IBM 5218

This is it—the top of the line. The IBM daisywheel entry, at \$3,680, is big and brawny, yet has the light touch when necessary.

It is one of the quieter daisywheel printers we tested, because it is so well insulated. And because IBM has designed this printer to perform its operations "on the fly" without actually stopping the carriage as it moves. This design results not only in a quieter printer, but in a faster print speed. Other companies are working on this principle, but Big Blue is clearly the leader for now.

The IBM 5218 just oozes establishment. You can imagine it sitting in General Motors's corporate offices with four PCs connected to it and four secretaries busily pounding away at their keyboards. Or imagine it in the offices of your up-and-coming young corporation, a printer that will fulfill the correspondence quality needs of any company as it grows. ■

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What's more, if your programs expected to find a file on a diskette in a particular drive, you had to make sure it was on that drive. You couldn't rearrange files to suit your own situation.

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COLOR PRINTERS ADD

Not too long ago computer users were happy to get any printout they could. Dull black and white suited us just fine. Now living color has arrived, and anything less is as passé as black and white TV.

When the IDS Prism printer was introduced a few years back, microcomputer users could finally print color text and graphics. Now, you can buy color printers at relatively modest prices, and some are even easy to use.

Color printers can brighten up your business reports and correspondence, not to mention your general outlook on life. Moreover, they work on fairly simple principles, which are extensions of the way black and white printers work.

The Impact Printers

The letters and graphics produced by impact matrix printers are made by metal pins striking an inked ribbon to form a pattern of dots that represent characters. For color output, most manufacturers have simply replaced the standard black ribbon with a multicolored ribbon. These ribbons come in either primary colors (red, green, blue, and black) or process colors (magenta, cyan, yellow, and black).

While primary colors are more commonly used for displaying color on a screen, process colors are much more useful because they can be mixed more effectively. For example, cyan and yellow produce green when mixed on top of each other, but no combination of red, green, or blue produces cyan or yellow.

To access the different color bands on

the ribbon, you insert control code sequences, such as EscQ3\$, into your text to shift the ribbon up or down to the desired band. At first glance, this method appears to suggest that you can use only the four colors on the ribbon. However, you can actually create many combinations of colors by performing multiple passes on a line using the different color bands.

The extent to which you can realistically use more than the four process colors depends upon your willingness to program several passes or the availability of software to do it for you. Some printers provide sophisticated control codes to ease the mixing of colors.

Because of the operating simplicity of impact color printers, you can distinguish only about 16 color shades in printed output. Fortunately, that number either equals or exceeds the number of colors supported on most currently available graphics boards for the PC. When color boards with more colors become available, color printer technology will have to be updated.

Ink Jet Printers

Ink jet technology sprays dots of ink on to the paper to produce the matrix dots. For color printing, you specify the desired shade by using control codes just like on impact printers. The difference in jet printing is that the printer uses the codes to determine which colors to spray onto the paper as the jets pass each dot. Most ink jet printers provide for the mixing of only seven very bright, different colors.

The only real drawback with ink jets is that you need to use special hard- or clay-coated paper. This paper ensures that the ink sets up quickly before the next color hits the paper to avoid the bleeding of colors. Multiple passes to produce different

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4695

Anadex
DP-9725B Color Scribe

Dataproductions
SPG 8051

IBM Entry Systems Division
Color Printer

Advanced Matrix Technology
AMT Office Printer

colors are not feasible because the more ink you spray in one place, the more the colors will bleed.

Color Graphics

To print color graphics, impact printers can be programmed to selectively print dots depending on the color band in use. Multiple passes are used to complete the line with multiple colors. Ink jet printers simply mix the colors onto each individual dot, so multiple passes are not necessary. For most purposes, all you need is software that can dump a color screen from the IBM graphics board. And many color printers come with software to do this. Check on the availability of this function before you buy a printer.

The resolution of a printer, stated in dots per inch (DPI), gives you an idea of

TO YOUR PALETTE



Photograph: Les Moraillo

the size of a printed image. The larger the number of dots per inch, the smaller the image. For example, when using a 72 DPI printer, a color image from the IBM color board will print 4.4 inches across by 2.7 inches high, or $320/72=4.4$. A 144 DPI image is half those dimensions, or a quarter of the size.

Some software can enlarge an image to be printed, but scaling them down is not easy. On the other hand, smaller images

often have blurred colors, especially on an impact printer. The key is to buy a printer that is able to produce images the size you need.

Making a Purchase

You should look for a color printer that can perform a carriage return without a line feed. This feature facilitates the printing of text and graphics together on the same line. While you might not always

need to do this, a necessary line feed complicates matters when the need does arise.

How much do color printers cost? Depending upon the list price of your choice of black and white printer, you can expect to pay between \$100 to \$400 extra for an equivalent color printer. Do you wish to add color to your business? A color printer could easily pay for itself by increasing the response on your efforts. ■

Radio Shack CGP-220

The Radio Shack CGP-220 is one of three color ink jet printers manufactured by Canon. (The other two are the Quadram Quadjet and Canon's own ink jet.) Owing to their common origin, they all resemble each other. But, numerous differences reside in the programs in their

vendor-installed ROM chips.

The machine I tested did not support screen dumps for the PC and did not appear to be compatible with either Canon or Quadram printer software. I was, however, able to print some test graphics, which appeared to have the same color saturation characteristics as those printed on the Canon did. Unfortunately, the CGP-220 cannot perform a carriage return without a line feed—it strips off the line feed if sent a CR/LF sequence. This is a disad-

vantage in advanced text processing, for it prohibits programming multiple passes of the printhead on a single line.

The CGP-220 operates in three modes: text, bit image, and color scan. Color manipulation is possible in all three, although its use is limited in the text mode. The printer recognizes up to 14 printer control codes. Any code it fails to recognize is either ignored or printed as an X with bars across the top and bottom.

The CGP-220 offers seven printable colors and can print each one individually or mixed with another. Two ink cartridges and a green lock lever enable printing with "no sticky mess." The manual mentions two possible problems with the cartridges. Operating the printer more than 1,000 meters above sea level may cause the pumping mechanism to lose pressure and temporarily malfunction. Radio Shack recommends acclimatizing the printer for 24 hours prior to use to avoid this. Also, bubbles may form in the cartridges if the printer is carried excessively, but a 6-hour rest will settle them.

The standard print features of the CGP-220 include elongated print, dot-pitch selection, and printhead positioning. It does not offer any print enhancements, so you are limited to one poor-quality type face. This makes the CGP-220 suitable only for draft versions of texts.

Without a boldface enhancement, the CGP-220 must rest on the laurels of its color printing. But the printer's incompatibility with PC graphics means there are problems even there. At present, Radio Shack does not offer a patch, and it seems highly unlikely that it ever will, especially when you consider the printer's full name: TRS-80 Color Ink Jet Printer CGP-220. So, if you want to use the CGP-220 to dump PC color graphics, you'll have to provide your own screen dump utilities.

These deficiencies make it impossible for me to recommend the Radio Shack CGP-220 for the average PC user, although it may be suitable for owners of Radio Shack TRS-80 computers.

—Vincent Puglia



CGP-220

Tandy/Radio Shack
400 Atrium, 1 Tandy Center
Fort Worth, TX 76102
(817) 338-2394

List Price: \$699

CIRCLE 708 ON READER SERVICE CARD

using the Power On Default feature(s).

AMT Office Printer

The big machine with the unpretentious name from Advanced Matrix Technology (AMT) looks good and sports some rather impressive features. Its name is Office Printer, plain and simple, and that's what it's supposed to be. It's not yet in production, though; the machine I tested was a prototype rather than the genuine article.

The good news about the Office Printer is its print quality. Here is a dot matrix printer whose correspondence quality looks almost as good as if it came from a fully formed machine. In the power-up default mode, it clipped along at an average of 37 cpi. The printer's single-pass memo mode is considerably faster; it compares favorably with what many dot matrix printers call letter quality. It also has a data mode, which is even faster but sacrifices some print quality.

The AMT Office Printer has a four-color ribbon in a monster-sized cartridge that may itself be larger than many of the printers we've tested, and the colors are called up by escape sequences. The letters used for setting up the codes are logical; for example, Esc-R-n calls up ribbon changes. Some of the more popular options use equally logical and easy-to-remember codes.

You need to make several passes of the printer to mix colors, so software compatibility is important for the Office Printer. It can print text and graphics on the same line and, therefore, is very useful when doing advanced word processing.

The printer did not come supplied with any screen dump software and did not work with either the DOS 2 or DOS 3.0 GRAPHICS.COM commands. AMT is noncommittal at this point as to whether or not they will supply any software with the printer when it is finally produced. I was able to produce some output, however, and the quality was on a par with similar printers.



AMT Office Printer

Advanced Matrix Technology
1157 Tourmaline Dr.
Newbury Park, CA 91320
(805) 499-8741

List Price: \$2,200

CIRCLE 698 ON READER SERVICE CARD

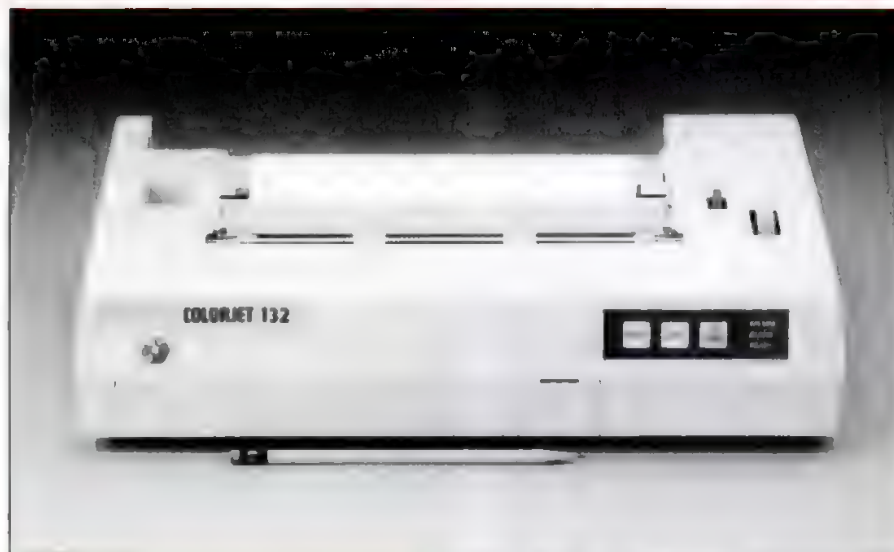
using the Power On Default feature(s).

The overall speed of the Office Printer was acceptable, but it was not as fast as that of most other color matrix printers. The resolution (60 or 120 dots per inch) is lower than that of most others and produces a larger graphic image. AMT suggests that it will improve the printer's resolution in the final version produced for marketing.

You select the print mode by using either buttons on the printer or program escape codes. The printer that I tested had

a half dozen different type fonts that you can also either select at the machine or call up by escape codes. More will be available as options. The printer even has codes that allow you to slant the type up to 30 degrees in 10-degree increments. Such a wide range of print options is quite unusual, and they are even fairly well documented.

The AMT printer also prints double-height as well as double-width characters. Vertical or horizontal spacing does not



Colorjet 132
 Integrex Corp.
 233 N. Juniper St.
 Philadelphia, PA 19107
 (215) 568-9681
 List Price: \$895

CIRCLE 687 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Power On Default feature(s).

automatically adjust to oversized letters, however, so unless you reprogram for wider spacing, the letters pile up on one another. That's a nuisance, and the manual I used failed to point it out clearly so that you could easily avoid it.

The machine is fairly fast but doesn't outdo any of the competitors waiting to eat the AMT Office Printer for breakfast. Marketing a machine like this one is an ambitious undertaking. AMT clearly has its work cut out if it's going to carve a niche for itself.—**Jim Forney**

Colorjet 132

After we tested dozens of printers for this project, some of them started to look awfully familiar. The Integrex Colorjet 132 was one of them.

A few manufacturers sell printers on an OEM basis to other companies, which place their own labels on them and then resell them. In an OEM arrangement, the reseller usually must add some value to

the product; this is what Integrex has done for the Colorjet 132.

The Colorjet 132 is a seven-color ink jet printer. It uses ink cartridges, making it easy to keep your hands and clothes clean. The printer's mechanism is made by Canon. Integrex, a British company, maintains an office in the United States to sell the Colorjet 132 and give technical support to users. The value Integrex added to the Colorjet 132 is the interface to the PC—specifically, to PC-DOS. With the Integrex software, the Colorjet 132 can perform graphics screen dumps, full text mode printing, and 1-2-3 graphics.

Integrex also supplies an optional interface for Viewdata graphics mode, which is a British Teletext system. Thus you also have a serial interface compatible with the RS-232 in addition to the standard port compatible with Centronics.

The Integrex screen-print software controls several aspects of the printed image, including the size, intensity, and mapping of screen colors to ink colors. While testing the printer's color graphics capabilities, I noticed that the colors appeared washed out in single-pass mode. The image looked better in double-pass mode. Integrex should have given the Colorjet 132 default mode capability, like other Canon OEMs.

The Colorjet can mix up to seven colors from its three ink jets. Setup and operation were straightforward. But I had to consult the manual to figure out why I got only one color at first. For advanced text processing, the printer cannot perform a carriage return without a line feed (it strips off the line feed if you send a CR-LF sequence). Thus you can't program multiple passes of data on one line.

The Integrex Colorjet 132 is a nice little printer for color graphics. The print quality was pleasing, but I felt that the colors produced by the other ink jet printers we tested were more vivid. My advice on how to choose between the Colorjet 132 and its near cousins is to buy this one if you need an interface with the RS-232 or Viewdata.—**Bill Harts**

Canon PJ-1080A

Are you ready to try an ink jet printer? If so, the Canon PJ-1080A should definitely be on your list of possibilities. It has color; it has some consistency with the IBM and Epson dot matrix control sequences; and it can print a color graphics screen image with some separately purchased software.

Setting up this printer is much like setting up a small dot matrix model. It has only one unusual manual control, a lever that controls the ink jet pumping initiation and shutdown. You must adjust this lever when you first set up the machine, when you move it, and when you are not using it for extended periods of time. Convenient instructions on the printer case tell you the exact sequence of lever maneuvers.

In this case, the "jet" in "ink jet" refers to the propulsion of ink onto the paper, not the speed at which printing is done. The actual print speed is more like a horse and buggy. Instead of printing a whole line of characters in one pass of the printhead, the PJ-1080A does only a row of dots. A line of characters involves 9 passes of the printhead, 18 if you're printing in boldface. In our tests, the speed was only about 23 cps for normal print and about 13 cps for bold.

The quality of normal text with the default settings looks a lot like that from an inexpensive dot matrix printer, but it's somewhat lighter. You can select boldface with a control sequence or a DIP switch, and bold is almost essential for printing straight text. The special IBM screen graphics characters do not print because the printer interprets the upper half of the 256 ASCII codes as Japanese Katakana and a few graphics symbols.

The printer cannot handle descenders on lowercase letters. Instead, these letters are moved up, making g's and q's look like funny 9's. The uppercase O has a little Q-like extender sticking out from the top. It appears that the two letters use the same

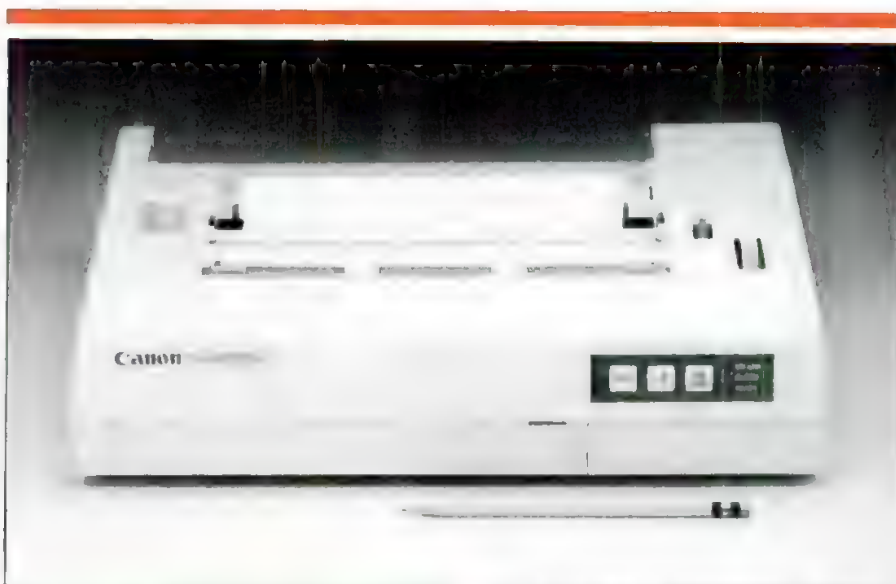
dot sequence, but in reverse.

The print quality depends on the paper used. The printer works best with specially treated roll paper that fits inside PJ-1080A, probably available where you buy the printer. Three rolls cost \$30. Only one side of the paper is treated; if you put it in the wrong way, the print looks terrible.

The roll paper is the only curse of this machine. There's a tear-off ridge, but if you print several pages, you'll find yourself folding the paper into 11-inch lengths.

The paper does not lose its curl. Fanfold paper tends to drift in the friction roller, and it gets mauled easily. You can also use single sheets of paper. Canon says that the machine is excellent for making transparencies for overhead projection.

Printed images look good on heavily coated paper, with very little bleeding. I tried printing the same image on regular coated paper, and it bled even less but looked quite washed out. So stick with the heavily coated stock. For color text, the



PJ-1080A

Canon U.S.A., Inc.
One Canon Plaza
Lake Success, NY 11042
(516) 488-6700
List Price: \$795

CIRCLE 735 ON READER SERVICE CARD

using the Power On Default feature(s).
using the Bold Print feature(s).

Canon can mix up to seven colors from its three ink jets. The printer cannot perform a carriage return without a line feed, however (it strips off the line feed if sent a CR-LF sequence), which prevents the programming of multiple passes of data on one line. Mixing text and graphics is therefore difficult at best. For most office applications, though, this is not a major limitation.

One of the best features of this printer is the user's manual. I have come to expect substandard documentation with printers,

but Canon's manual is complete, well thought out, and easy to read. The layout is exquisite. The setup procedure is explained with clear drawings and large type. The section on control sequences allows at least one full page per sequence, and the information is presented in a uniform format for easy reference. Some errors mar the control-sequence documentation, however.

Because of its roll paper, slow print speed, and light character printing, the Canon PJ-1080A will probably not be a

good substitute for a dot matrix or daisy-wheel printer. But as a second machine for printing pictures and making presentation graphics, it's an excellent choice, and at \$795 a relatively inexpensive one.

—Charles Petzold

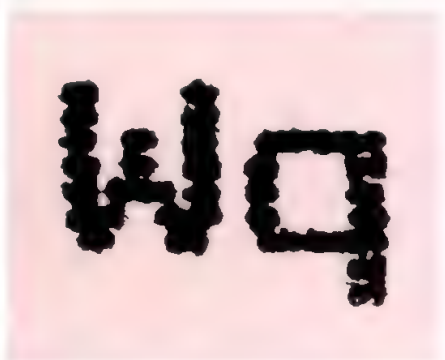
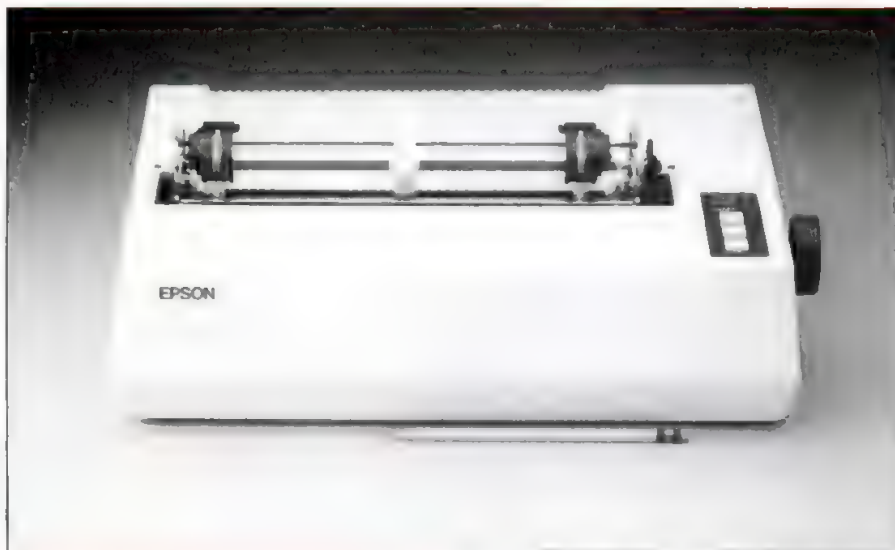
Epson JX-80

I've never been a special fan of Epson printers, but I do have to admit that the new Epson JX-80 made quite a favorable impression; it's a nice little machine. You can see its FX-80 ancestry at a glance, but this printer is clearly better in a couple of ways; even besides the fact that it prints in color.

The JX-80 I tested was equipped with the optional tractor assembly, which is a nice feature in itself. It adds about 1½ inches to the height of the machine, and Epson made a humped plastic cover to enclose the assembly. This attention to detail helps make this printer a quiet and smooth-running machine.

The JX-80 has a full bag of tricks, including five popular pitch sizes, expanded and compressed print, and fonts including italics. You can call up your choice of fonts from programming or by pushing combinations of buttons on the printer's control panel. In its wide-open data print mode it is no speed demon, but it averages a very respectable 71.9 cps. The JX-80 zips along at 47.9 cps as it prints in emphasized mode, which gives decent letter quality, with a single pass. However the JX-80 manages to do this, it works, it looks good, and it doesn't waste a lot of time.

This Epson has the standard enhancements—boldface, underlining, and so on—and they all look pretty good. Unique to Epsoms, including this one, are subscripts that are half-height. Make them condensed as well and you have some of the neatest little text you can imagine. And the half-height characters are surprisingly readable—they even hold up under scrutiny with a jeweler's loupe.



JX-80

Epson America
3415 Kashina St.
Torrance, CA 90505
(213) 539-9140
List Price: \$749

CIRCLE 688 ON READER SERVICE CARD

using the Power On Default feature(s).
using the emphasized feature(s).

On power-up, the printhead mechanism of the JX-80 does the usual back-and-forth exercise, and then it also goes up and down as it checks out the four ribbon color positions.

I did some successful black-and-white screen dumps to the printer and also tried out the six colors plus black that you can coax out of the four-color ribbon on some text. The JX-80 can certainly do the job. I did encounter a problem when I tried to print a screen in color. The printer doesn't come with software for color screen dumps or work with the DOS 3.0 GRAPHICS.COM command. Plan on spending an additional \$50 to \$100 for software to add color to your screen dumps. We tried some custom software and found that the printed images are quite satisfactory for most purposes.

For printing text, Epson has included seven color control codes to help users mix their own colors (some printers that cost twice as much provide for only four codes). You can confine the codes in multiple passes to produce a vast array of colors, and text and graphics can appear on the same line.

The more I worked with the JX-80, the better we got along. This is one printer I'd like to take home some day.

—Jim Forney

Diablo C150

It's not often in this business that we have the opportunity to wear the products we've tested—or that we really want to. Unfortunately, I'm still wearing fading, amorphous tattoos of Diablo cyan and magenta as I sit here writing, some hours and scrubbing after the encounter. Several steps are involved in getting the Diablo C150 ink jet printer up and running, all carefully detailed in the instruction manual, with one omission: wear rubber gloves, or perhaps a wet suit.

I'd hardly touched a thing when I discovered the first fresh, bright smear. I told myself, "Hey, dummy, be a little care-



C150

Diablo Systems, Inc.
1510 Trimble Rd.
San Jose, CA 95131
(408) 263-7704

List Price: \$1,250

CIRCLE 737 ON READER SERVICE CARD

using the Power On Default feature(s).

ful!" And I hadn't even gotten to the good part. That comes when you have to remove eight—count them, *eight*—nasty rubber plugs and one plastic cover, all of which come out dripping ink. You have to wash them carefully and save them in case you ever have to move or ship the machine again. They get slippery under a faucet, and then there were seven.

The printer is fussy about being level; a built-in bubble in the bottom tells you when it's within 2 degrees of being level. (You may have to level your *table* first to

get within this range.) You're warned never to tilt the printer more than 5 degrees unless you've secured and plugged it the way it was during shipping. Still, it took me only an hour after opening the box to print out the built-in diagnostic test pattern, which I didn't think was bad.

The Diablo C150 produces very nice color graphics on the recommended clay-coated paper (great, if you can find it). In fact, it had the sharpest-looking output of any printer I tested. With hard-coated or plain paper, however, the image quality

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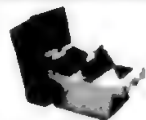
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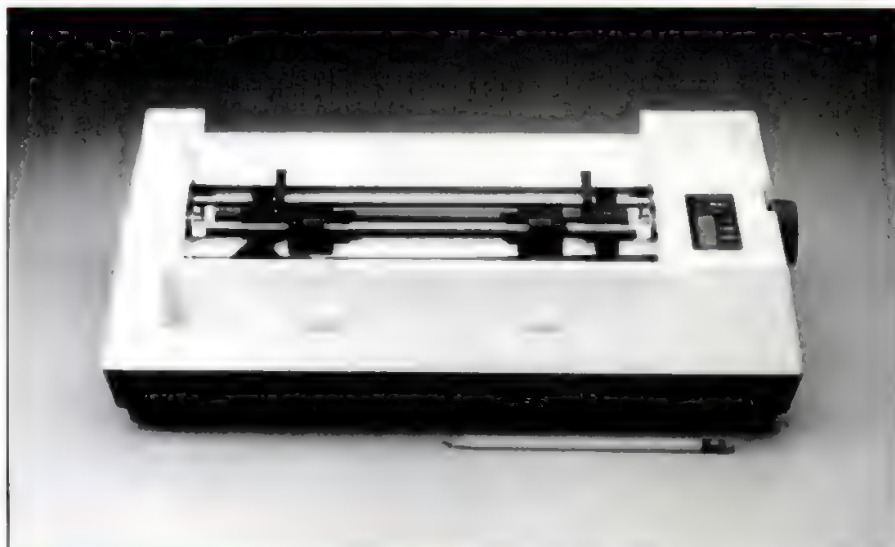
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San Fernando, CA 91340

(818) 365-9521

List Price: \$599

CIRCLE 731 ON READER SERVICE CARD



using the Power on Default feature(s).

deteriorated quite a bit, although it was still acceptable for drafts. You can print both text and graphics on the same line; so advanced text and graphics processing are possible. You can specify as many as seven colors for either text or graphics, and the colors are very bright.

Diablo does not supply any software with the printer, but they do recommend several packages and even offer some of them at a discount to purchasers (as penance for the printer's high price?). The true resolution of the output (without inter-

lacing the dots) is higher than that from most printers, resulting in smaller-size pictures. Whether this higher-resolution output is good or bad depends on your intended use. I happen to like it.

You wouldn't buy a color printer just for its text output, but you expect text printing of almost any type of printer on occasion. The C150 did not stacked up well in text print quality and certainly not in speed. The horizontal parts of letters tended to come out looking doubled.

The speeds for printing text were

embarrassingly slow: 13.6 cps in the fastest bidirectional mode. (The manual tries to sneak around that point by telling you only how long it takes to print a line.) It drops to less than 8 cps in the supposedly higher-quality unidirectional mode, though there's no significant improvement in quality. To look at the C150 you'd think it was printing much faster, but it takes four passes of the printhead to finish a single line of text. On the other hand, the C150 is so quiet during operation that you can take a nap while you're waiting. The C150's need for special coated roll paper also limits the printer's usefulness for text, although this characteristic is certainly not unique to this machine.

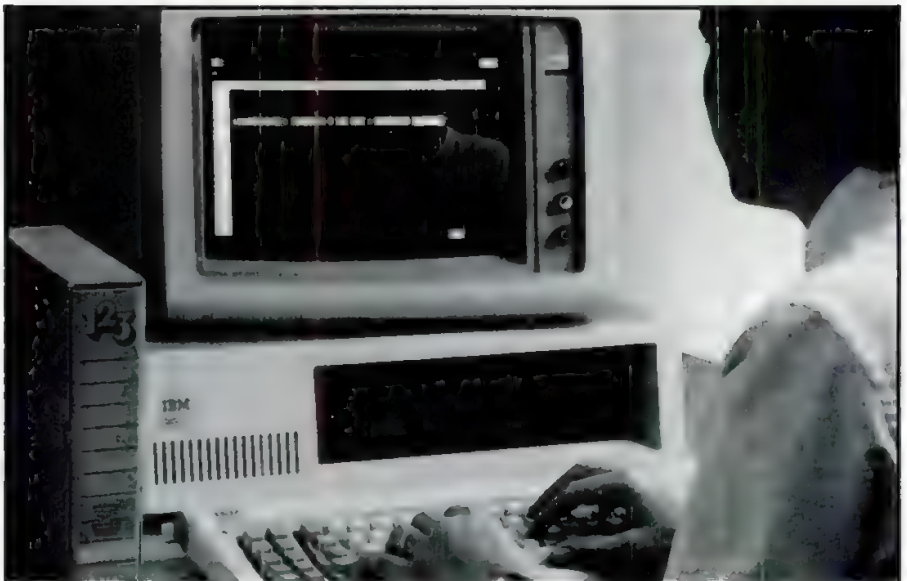
The Diablo C150 has all the keyboard or software-selectable tabs and margins you'd expect but surprisingly few text features. Unless the manual is hiding something, there's only one type size, and about the only special features I could find that were worth trying were printing text in one color over a background of another and using one of six primary and supplementary colors instead of black. The printer handled these features rather well.

Preventive maintenance is a must with this kind of printer. You cannot ignore an ink jet printer as you can other kinds of printers and have it love you when you come back to it. The manual is fairly large as printer manuals go. As you get into it, you find that it has much more about how to prevent or cure the problems ink jet printers are prone to than about making the C150 do nifty things for you.

—Jim Forney

Seikosha GP-700

You'll be thankful that the GP-700 can print in different colors, because the normal black printing is dreadful—faint even with a new ribbon. And one of the colors, the yellow, is worse. It looks like invisible ink—you have to hold it up to the light to read it. Purple is the only color that stands out properly, so you may find



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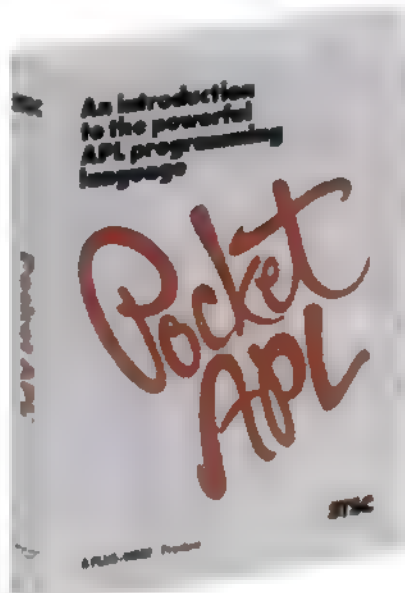
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System requirements: Minimum 128K of memory IBM Personal Computer, IBM PCjr., and true compatibles equipped with PC DOS or MS DOS operating systems. Pocket APL uses a soft character set for computers with graphics board or color monitor; keywords for computers with monochrome



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CIRCLE 431 ON READER SERVICE CARD

yourself doing lots of purple printing on this machine. If you're a kid who wants to use your computer to send word-processed love letters to the object of your desire, this may suit you perfectly.

The different colors come from a compact ribbon cartridge with individually replaceable inkers. The ribbon colors are black, cyan, magenta, and yellow; combinations of which generate red, green, and purple. The color combinations print out nearly as fast as the black and single colors—though at only about 22 cps.

The team of Seikosha and Axiom offers several models of the GP-700—a “PC” suffix means it's for an IBM PC. Unfortunately, I received a GP-700A printer with a GP-700PC plastic lid. According to the marketing literature, the GP-700PC “includes VDI software for compatibility with GKS in MS-DOS 2.0.” This software, I was told by Axiom, is disk based and provides a standardized color graphics printer interface for applications programs. The company claimed that this software would print a color graphics screen display from the IBM PC. Unfortunately, the GP-700A I received did not give me the opportunity to try it out, since Axiom's only copy of the disk had been lent to Seikosha.

Lacking Axiom's software, I was forced to use a third-party package to test graphics on the printer. Printed images had a washed-out look to them, even after I replaced the ribbon and printed two passes per line. The GP-700 prints seven individual colors without mixing control codes. That makes it easy to print multi-colored text. Since it can print both text and graphics on the same line, it's suitable for advanced text processing.

The Axiom GP-700 is disappointing on its own terms, but Axiom's lack of care in servicing its customers is even more worrisome. Both this printer and another of Axiom's models, the GP-500, arrived in incorrect configurations. I have to recommend that you deal with this company very carefully. —Charles Petzold

Tektronix 4695

Tektronix manufactures graphics terminals, which is probably why they call the 4695 a Color Graphics Copier instead of just a color ink jet printer as anyone else would. The 4695 *does* make pretty copies of IBM PC color graphics screens; so perhaps “copier” isn't that bad a choice.

You do pay a price for those handsome pictures, however. I knew I was in for a

learning experience when I found that the manual had 30 pages of instructions on how to unpack and repack the printer. Evidently the printhead is an especially sensitive piece of equipment; you must remove protective caps, bathe it in mystical fluids, and slide it back and forth on its track as you perform the ritual of preparation. Even more ominous was the presence of two separate syringes in the supply kit.

It took me a full 45 minutes to get it ready for its self-test. Many steps are involved in handling the ink cartridges,



FACT FILE

Tektronix 4695
Tektronix, Inc.
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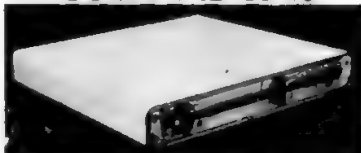
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which can be messy even if you are careful. Now, more than a day later, my fingertips are lovely shades of cyan and magenta.

I have two gripes about the setup process aside from its complexity. The instructions are in the last chapter of the manual, but the text sends you to other sections in the front of the manual several times. The other problem is that you are instructed to make certain that the printer is within 2 degrees of level. Tektronix thoughtfully provides a bulls-eye bubble level mounted in the base of the printer but then tells you to fix any problem by "adjusting the surface"! Wouldn't it be simpler to put adjustable feet on the printer to compensate for a slanted table (or building)?

This machine is not designed for printing text. While the ink drops are fairly fine, the quality of the print is about the same as from most dot matrix printers in their draft mode. Besides that, it is *slow*. Rated at 20 cps, the 4695 tested out in our standard task at just over 15 cps. Most inexpensive daisywheels go at least that fast. It is slow because the printhead must make four passes to print each line, and there are no other (quicker) fonts available.

The machine shows its capabilities when you load up the *Tekcopy* utility. This software is free (though you must request it after you buy the printer) and is a driver similar to the IBM *Graphics* utility. After you load *Tekcopy*, you are presented with a menu that allows you to select the ink colors that are to be printed in response to the different screen colors. This driver then stays in memory, and you can simply use the Shift-PrtSc key combination to get a paper copy of any graphics screen.

The color printing was good in our test. The colors were vivid, and there were no streaks of too much or too little ink. Tektronix supplied a roll of coated paper that they recommend for best results (six rolls cost \$50 and are roughly equivalent to 1,000 sheets of letter-size paper). I also tried it with standard 20-pound fanfold

paper. On that, the ink bled a little, but not nearly as much as with some other ink jets.

Both text and graphics can be printed on the same line, and so advanced text and graphics processing is possible. Up to seven colors can be specified for either text or graphics, and the colors are very bright. The printer comes with some color-screen hard-copy software that allows for color mapping, sizing, and more. The true resolution of the output (that is, without interlacing the dots) is higher than with most printers, resulting in smaller-size pictures. Whether this is good or bad depends on your intended use.

On the whole, I felt that this printer was more trouble than it was worth. It seems to be suited best for a graphic-arts operation since it is too specialized and demanding for general use.—Alfred Poor

Dataproducts SPG 8051

I knew that I had something new on my hands when I saw the manual for the Dataproducts SPG 8051: an inch-thick stack of uncollated, poorly photocopied pages stuffed in a plastic bag. The top page was clearly stamped "PRELIMINARY, FOR REFERENCE ONLY," and the handwritten notation "UNAPPROVED" appeared for good measure.

Because many pages were missing and the rest were out of order, I was unable to test some of the fancier features of this printer (and it is a fancy one). This was very frustrating, since the sample of color printing that came with the unit displayed type styles and print quality that I could not duplicate with the available instructions.

The SPG 8051 is a powerhouse of a printer that offers excellent print quality, color, built-in text justification, reasonable speed, and a triple paper path (front, rear, and bottom). In addition to setup command sequences (which are compatible with the IBM PC Color Printer), it also

features switches on the front control panel that produce printed responses. I found it easier to feed in the command codes from the PC, but another user might prefer a dialogue with the control panel.

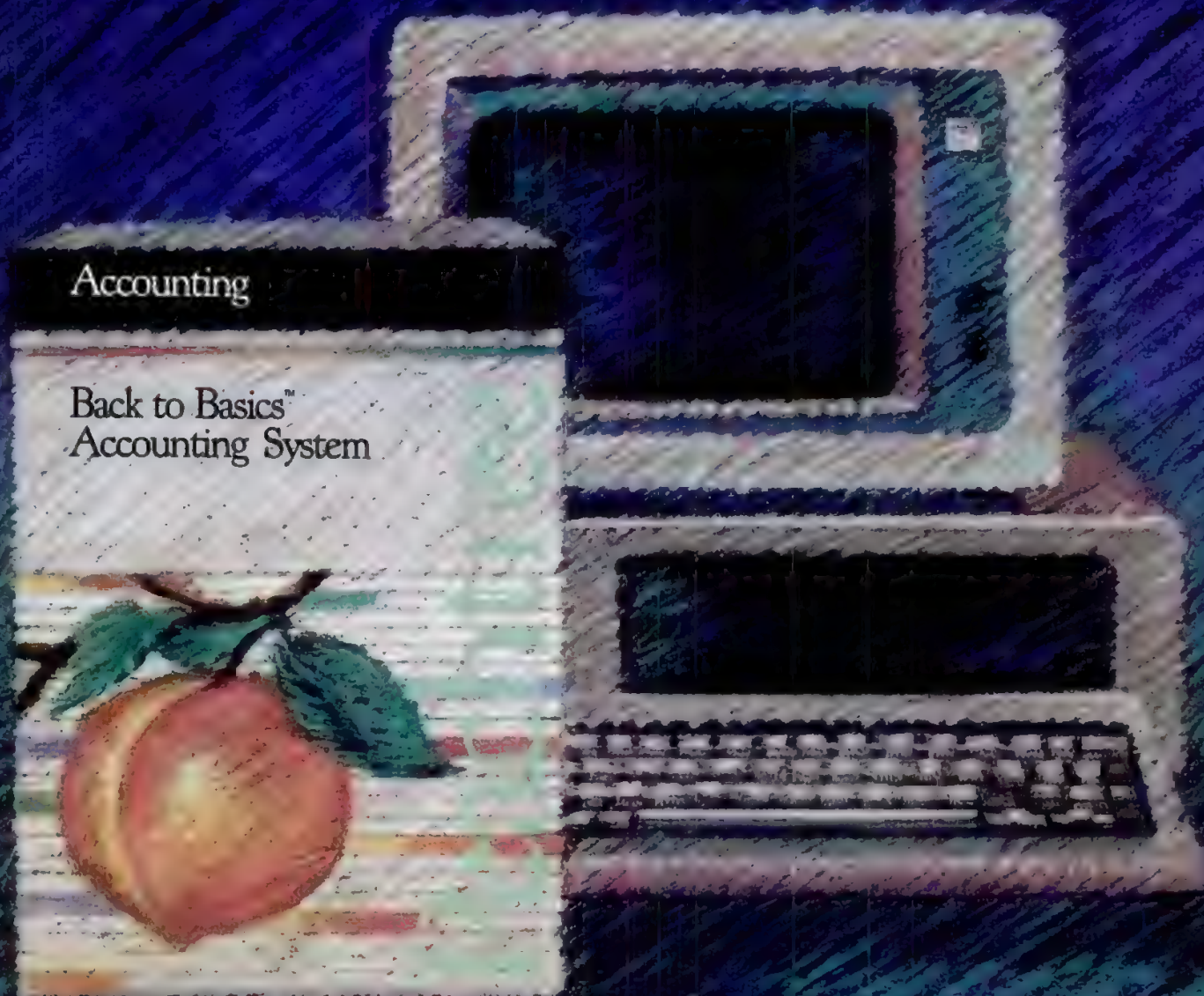
The SPG 8051 machine is basically the same as the IBM Color Printer that Dataproducts produces for Big Blue and is also completely software compatible with it. This IBM compatibility is the best feature of the 8051, for soon every graphics software company will support it. You'll be able to use it for many applications. The Dataproducts 8050 printer is similar to the 8051 but is compatible with the earlier Dataproducts P-series printers and the IDS Prism series printers, rather than the IBM printer.

The new PC-DOS 3.0 GRAPHICS.COM command will support hard copy printed from the screen of the 8051, although the process was slow when I tested it. The printer control codes refer to the ribbon positions rather than the colors themselves (for example, cyan is position 3). Secondary colors can be printed by mixing the three colors on the ribbon. However, the mixing must be done in several printhead passes using multiple control-code sequences, which complicates the use of secondary colors in text documents.

The quality of graphics images is good, although the heavy use of color with a new ribbon produces some waves in the paper, as with most color matrix printers. Graphics and text can be printed on the same line, and the paper can even be reverse fed if necessary.

Three standard print modes are available: draft, text, and letter quality. Since I could find no instructions for changing modes in the jumble of pages provided as documentation, I had to stay in text mode, the default condition. The enclosed sample of letter quality printing was really impressive and better than anything I could create by combining shadow print with double-strike printing in the text mode. The character formations are excellent, and superscript and subscript print are as

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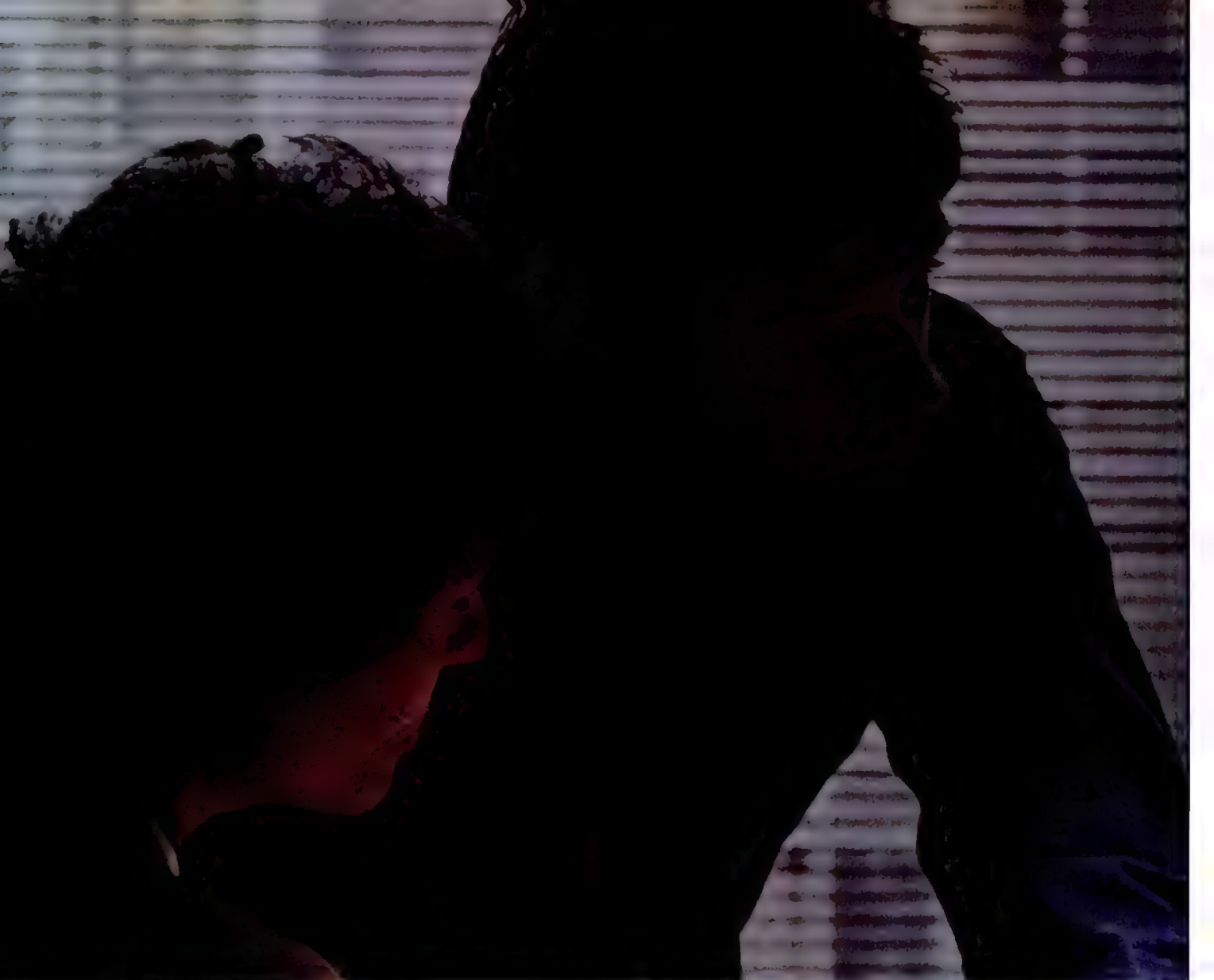
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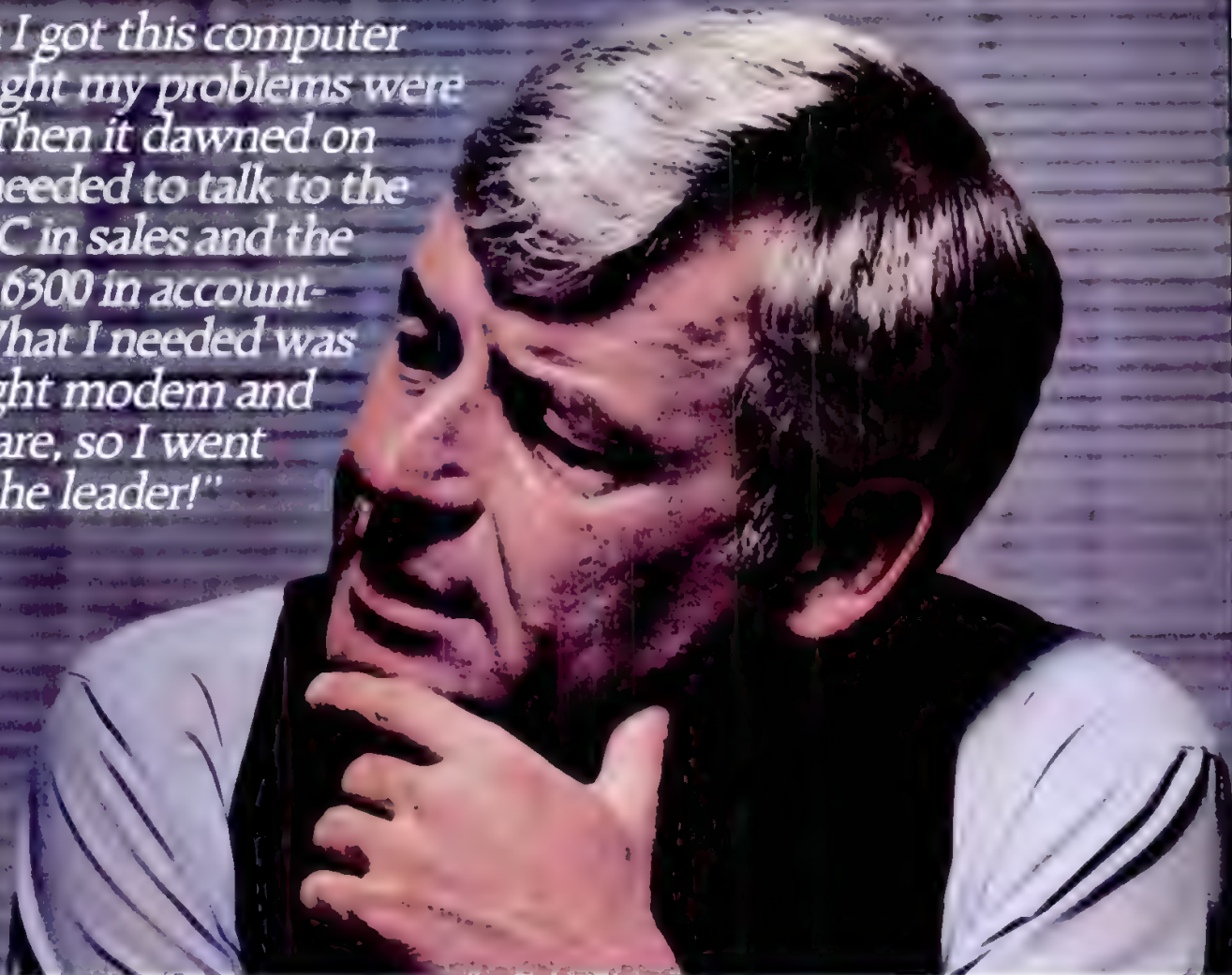
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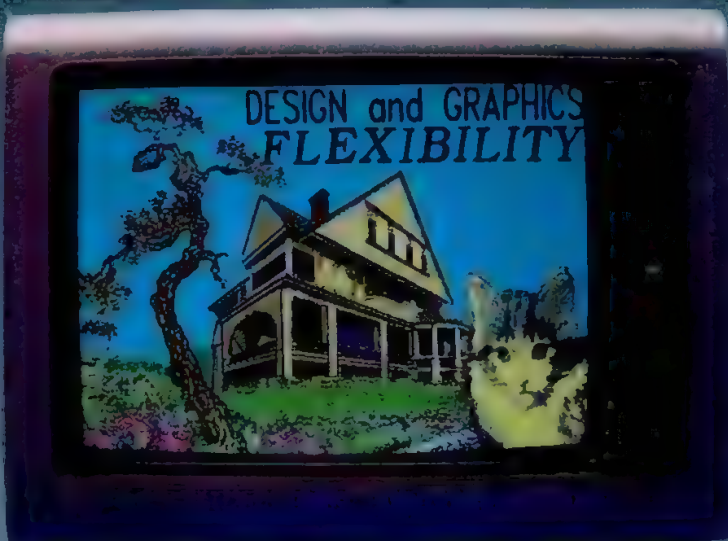
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CIRCLE 184 ON READER SERVICE CARD

CHORUS

Chorus Data Systems, Inc., 6 Continental Blvd., P.O. Box 370, Merrimack, New Hampshire 03054

perfectly formed as the main print line.

The SPG 8051 is the slower mate to the SPG 8071, which was not available in time for review. The manufacturer rates the SPG 8051 at 200 cps in draft mode, 110 cps in text mode, and 35 cps in letter quality mode. It rates the 8071 at double these speeds. I got the 8051 to produce 98.6 cps in unenhanced text mode and 20.3 cps with the shadow/overprint enhancement in effect.

The motors in the 8051 are quite large and produce a very crisp, rapid head motion and a high paper turnover rate. In fact, this printer shoots paper so fast, that without a paper tray the ejected forms wrap around and feed back into the rear paper inlet at great speed. (This happened to me four times during the various testing stages.) It's a snap to load forms into any of this printer's three paper paths.

The only criticisms I have concern the lack of a manual platen knob for paper adjustment and the use of a unique ribbon cartridge that is only available from Data-products (for \$19.95 each).

At \$1,895, the SPG 8051 costs slightly less than the IBM Color Printer but is otherwise almost identical. It's one of the few I've seen that really prints the full IBM character set, including the smiling faces (in both colors) and all those other interesting symbols. It won't allow you to download your own character set, but otherwise it's about as complete as you could want. In addition, paper and ribbon are more easily accessible in this machine than in the IBM version. If you are considering buying an IBM Color Printer, consider the SPG 8051 as a good alternative.—John Phillips

Quadram Quadjet

With a Quadram Quadjet, you can create a rainbow more brilliant than any that ever graced Oz. But that's only half the story. Not only does the Quadjet create outstanding color graphics, but this compact ink jet printer also prints in boldface,



SPG 8051

Dataproducts
Route 13 South
Milford, NH 03055
(603) 673-9100
List Price: \$1,895

CIRCLE 697 ON READER SERVICE CARD

using the EMPHASIZE feature(s).

using the DUBBLESTRIKE feature(s).

using the ENPH/DUBBLE feature(s).

a text enhancement most other ink jet printers lack. In addition, many third-party software companies have supported it, making it even more useful for certain applications.

Since the Quadjet is not meant for word processing, it has few of the features common to printers that are. There is no elite or compressed type. Besides bold, the only other type enhancement possible is an enlarged (elongated) face. But you can define the line-feed pitch at either six or eight lines per inch, and, of course, there

are the color and graphics codes. You can specify any of eight colors, including white (which doesn't print).

The colors are bright, especially when you use the coated paper provided by Quadram. Even if you use plain single-sheet paper, or letterhead, the quality is quite impressive. The only possible complaint is a slight bleeding at the point where two or more colors meet. The bleeding was pronounced on plain paper, less noticeable on the more absorbent (and more expensive) clay-coated paper.

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In single-pass mode, the printing was crisper on the hard-coated paper, but the colors had a washed-out, pastel look. For color text, the Quadjet can mix up to seven colors from its three ink jets. Unfortunately, the printer cannot do a carriage return without a line feed (it strips off the line feed if sent a CR/LF sequence), which prohibits multiple passes of data on one line and makes it all but impossible to print text and graphics on one line.

Although the Quadjet is not truly compatible with the IBM PC's graphics,

Quadram supplies an easily installed three-program diskette to remedy the problem. The first utility provides a Ctrl-PrtScr screen-dump function. The second routine modifies the colors of the image, whether text or graphics, before the PC sends them to the printer. This feature is especially handy for people who are uncertain which colors to choose for any given graph. The third program allows IDS (Integral Data Systems) emulation by converting IDS PRISM printer data to a Quadjet print mode.

The Quadjet uses only two ink cartridges, one black and one for the colors. Quadram claims that each cartridge is good for approximately eight rolls of paper. Installing them is simply a matter of slipping each cartridge into its respective compartment in the rear. As with M&M's, there's no mess on your hands.

To make sure the ink doesn't leak out when the printer is transported, there is a green lever at the upper left of the housing that locks the cartridges and carriage in place. Closing it is also supposed to prevent the cartridges from drying out during extended storage.

The 32-page documentation may seem too little at first glance, but it is more than enough. It is clearly written and filled with illustrations and examples.

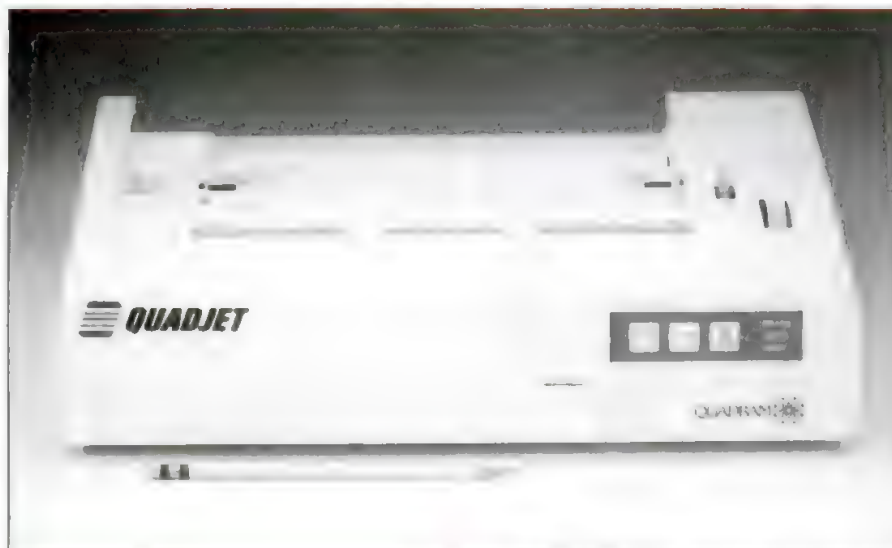
The Quadram Quadjet may not be the fastest printer around—its power-on default rating was just under 23 characters per second—but it may be the best buy around in color ink jet printers. It is priced so low that even if your need for one is marginal, you could still pamper yourself and buy one.—*Vincent Puglia*

Anadex DP-9725B Color Scribe

The Anadex Color Scribe is a class act from the moment you open the carton. The strikingly attractive printer is built from quality materials with considerable attention to detail. It is capable of printing color graphics output with good resolution, as well as top-quality correspondence output at speeds well above average. It is definitely not perfect, however.

The printer took much longer to set up and test than it should have. The flexibility of its features, which is great, requires a lot of manual-reading before you are comfortable enough to power it up, and the quality engineering is marred by several truly annoying faults.

A three-color ribbon cartridge is supplied with the Color Scribe. I turned to the



using the Power On Default feature(s).
using the bold print feature(s).

Quadjet

Quadram Corp.
4355 International Blvd.
Norcross, GA 30093
(404) 923-6666

List Price: \$895

CIRCLE 736 ON READER SERVICE CARD



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Plus, the SB384 comes with software for RAM-Disk emulation and print spooling: a total of seven functions in just one slot.

Now you can decide.

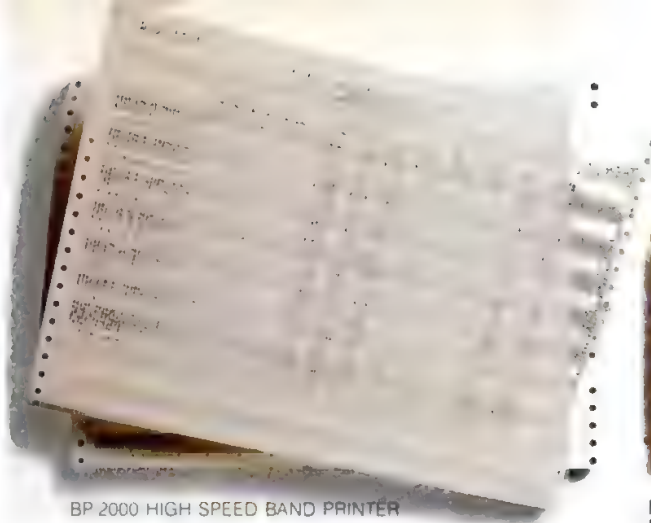
As you can see, the best way to decide on which multi-function board is right for you is to look at more than just the board. Examine the warranty that stands behind that board, the quality that goes into it, and the features

it offers. This way you'll discover that Persyst is way ahead of the others in every area.

The Persyst SB384 is a product of Emulex Corporation, an industry leader in the development of high-performance controllers, communications products and packaged subsystems for PCs, micro, mini and super minicomputers. For more information call or write us today. Persyst Products, 3545 Harbor Boulevard, P.O. Box 6725, Costa Mesa, CA 92626. Tel. (714) 662-5600.

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BP 2000 HIGH SPEED BAND PRINTER



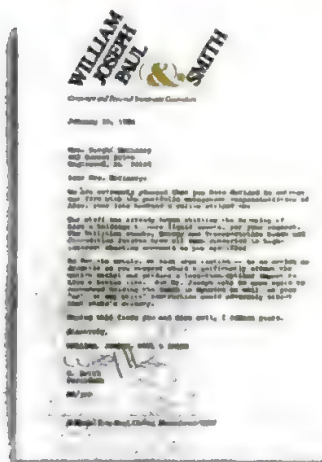
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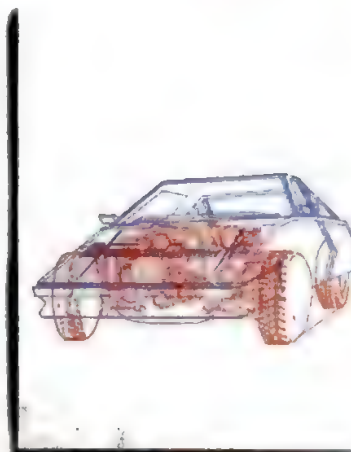
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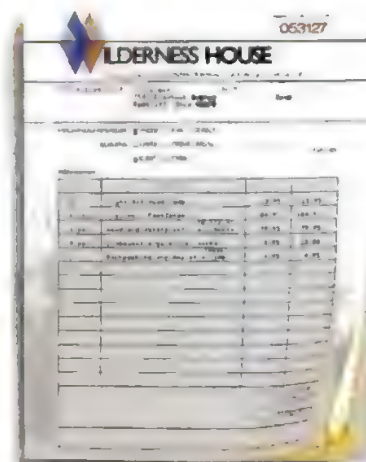
8070 MATRIX PRINTER



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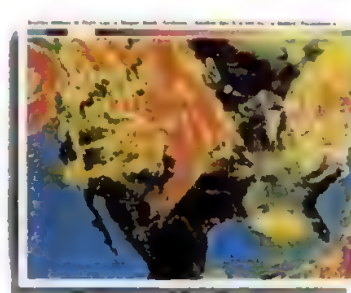
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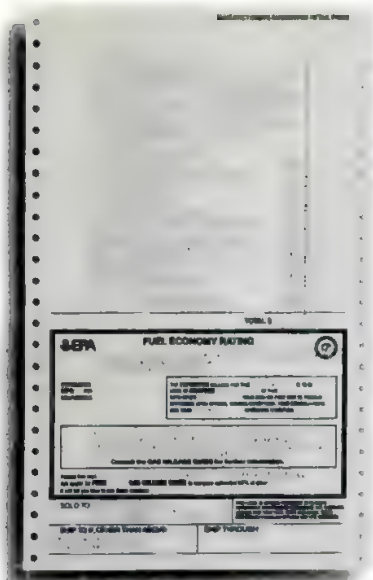
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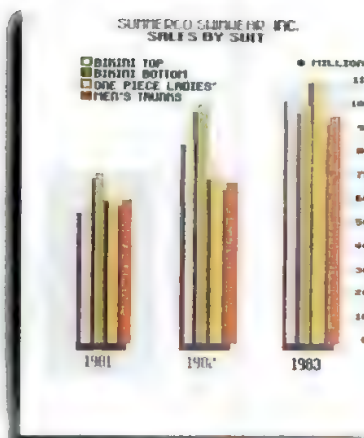
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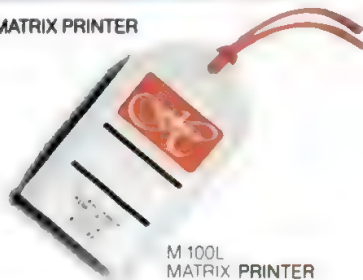
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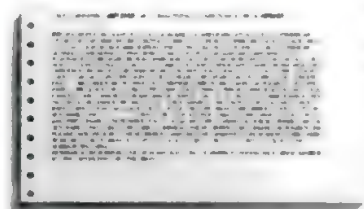
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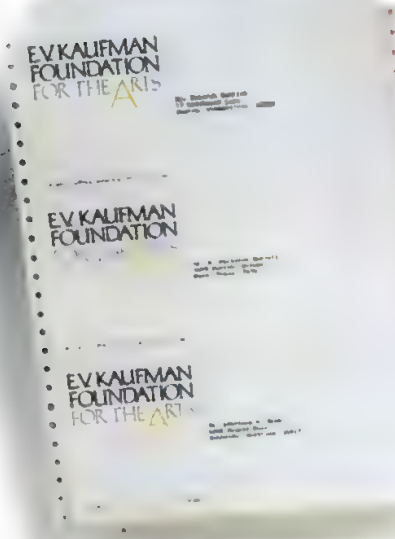
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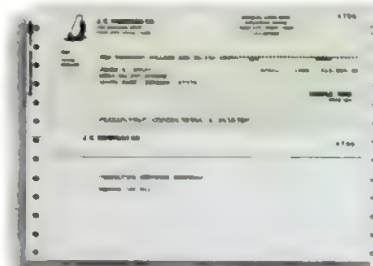
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8050 MATRIX PRINTER



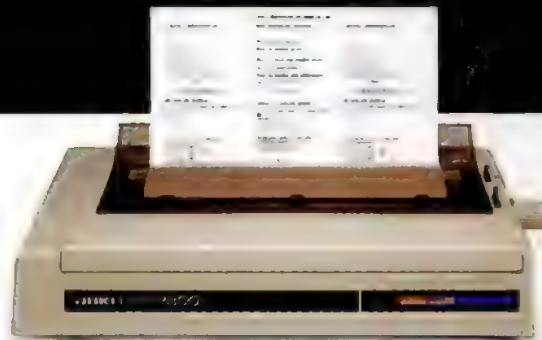
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setup section of the manual and was confronted with an 18-step procedure (supported by nine pictorials) just to install it! I got it in right on the second try, though.

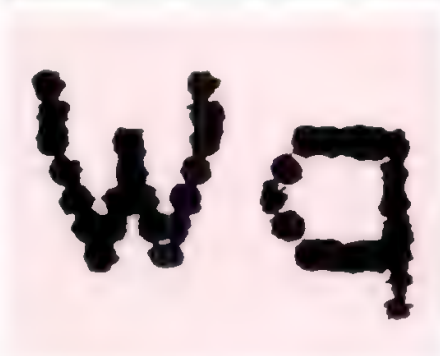
The low point of the morning, however, was attempting to install the paper. The DP-9725B Color Scribe is designed for either bottom or rear feed. Since *PC Magazine* provided a tabletop surface for the

The DP-9725B is a heavy-duty printer for high-volume operations.

testing area, I bypassed the straight-path bottom feed for the one on the rear of the unit. Twenty minutes later, I had to enlist help, since it clearly took more than two hands to perform this simple function. We finally gave up, propped the printer up on books, and used the bottom feed. Forget the rear slot, and watch out for the paper-out sensor when you load paper. Follow the 11-step procedure (with three photos and one drawing), and you will get it in eventually.

The manual's instructions for running a self-test were wrong, and I lost another 30 minutes figuring out how to get the self-test to execute. When I did, a six-color printout was my reward. In addition to a RAM check, the printout displayed the physical setup, DIP switches, line width, buffer status, and a test pattern. That's the way it ought to be on a high-powered printer like this one.

Setup problems aside, the Color Scribe is a fine printer, and for a heavy-duty, high-speed dot matrix machine gun, it is amazingly quiet. The entire mechanism is shielded with sound-deadening material; there is a foam-seal gasket around the removable view panel; and an acoustic mat is supplied. The specs say the noise



DP-9725B Color Scribe

Anadex, Inc.
1001 Flynn Rd.
Camarillo, CA 93010
(805) 987-9660
List Price: \$1,625

CIRCLE 741 ON READER SERVICE CARD

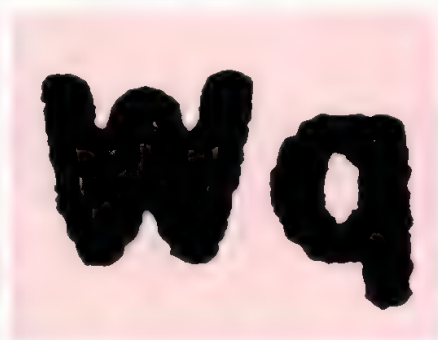
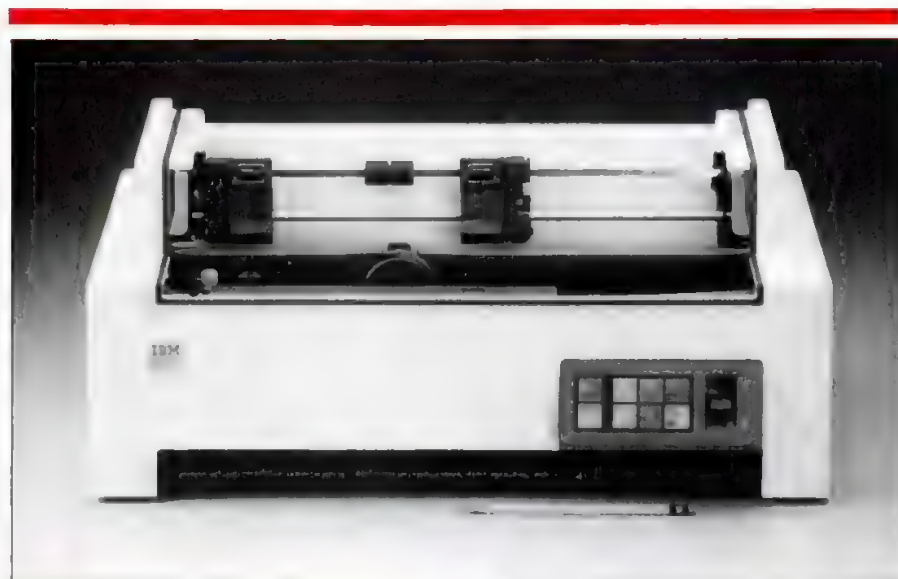
using the Power On Default feature(s).

level is 55 db, but at 12 inches from the printhead we measured considerably more. The sound quality is like white noise rather than the harsh metallic racket so often associated with matrix printers. It's almost pleasant.

With the printer properly set up for text work, the *PC* test program for the character set showed a repeat of low-order characters for the high-order ones. The DP-9725B did not print the IBM graphic characters, but it didn't crash either.

The Anadex performed excellently

when printing text. Print speeds ranged up to 240 cps for draft material, with correspondence quality at about 138–140 cps. I would not classify this as a near-letter quality printer, but it is well within the mainstream. There is a wide array of style and font options, all software selectable. You can print double-wide, pica, elite, compressed, proportional, super/subscripts, underscored, dual-pass, or shadowed in your choice of six languages as well as 15 colors. The proportional font with shadow enhancement gave the best



IBM Color Printer
 IBM Entry Systems Division
 1615 S. Congress Ave.
 Delray Beach, FL 33444
 (305) 241-5074
List Price: \$1,995

CIRCLE 740 ON READER SERVICE CARD

using the Power On Default feature(s).

using the near-letter quality, emphasized, 10
 using the near-letter quality, emphasized, dou

quality for correspondence.

In the area of color and graphics, the first thing I noticed was the speed and quietness of the printer. Even while it was printing colorful graphs, the printer zipped along without hesitation.

To help you get started, Anadex provides useful screen print software that enables you to print screen graphics in several different sizes. You can even change the colors, so it's not just a straight screen-dump program. When you wish to color text, one simple control code is all that is

needed to produce up to 15 different color combinations, so color can be added without much effort.

Text and graphics can be printed on the same line, which makes advanced text processing possible. Graphics can be printed at either the standard 72 dots per inch or with the dots interlaced at 144 dpi (which results in smaller-sized output). This flexibility can be valuable if you want to use the printer for more than just presentation graphics.

Ribbons for this printer are expensive

at \$216 per dozen, and I have no figures on ribbon life. The printer requires a slot-loaded stand if you don't want to fight with paper jams all day. A serial interface is available for an extra \$100, and it is field-installable.

Anadex rates the DP-9725B's duty cycle at 100 percent with an MTBF of over 4,300 hours. Those are heavy-duty specs. This is a heavy-duty printer for a high-volume operation. And I still like the sound! If I had to sit next to a printer, I would pick this one over any other that I have used so far.—**John Phillips**

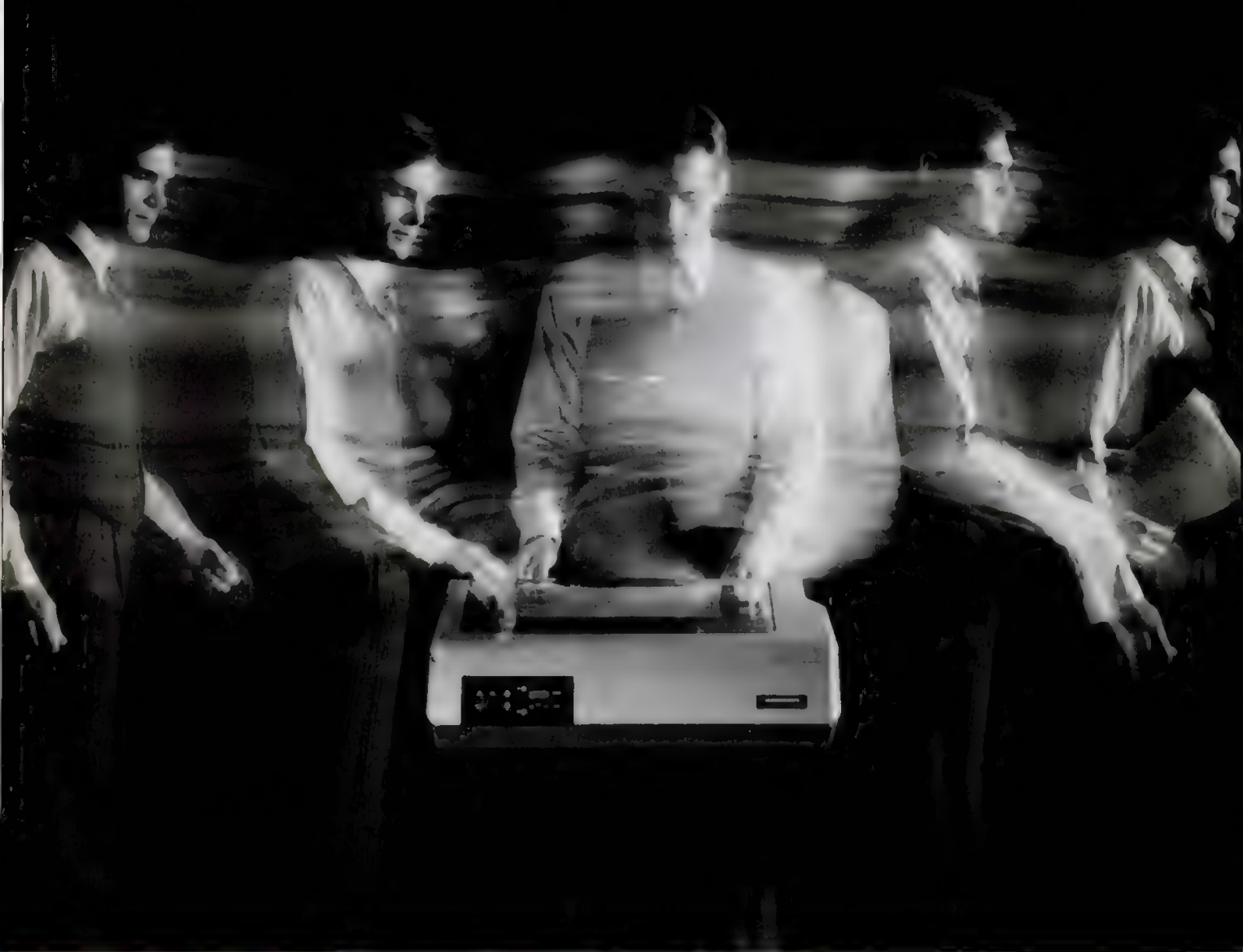
IBM Color Printer

The IBM Color Printer is a typical IBM product. It does the job, it's well documented (possibly overdocumented), but it lacks pizzazz. Although powerful, the printer loses some of its usefulness by not making its features easily accessible to the average user.

Graphics screen dumps to the printer are finally available in the new PC-DOS 3.0 GRAPHICS.COM command, although it seemed incredibly slow when I tested it. With older versions of PC-DOS, the printer can't reproduce screens correctly even in black and white.

The printer has control codes for the ribbon positions (for instance, ribbon 3 is cyan) instead of the colors themselves. You can print multiple colors by mixing the three colors on the ribbon, but this takes several passes through the use of multiple control-code sequences. Printing text in multiple colors becomes rather complicated.

The quality of the printed image is good, although heavy use of color with a new ribbon produced some waves in the paper. It can print graphics and text on the same line, and you can even reverse feed the paper if desired. Of course, every graphics software company will soon be supporting this printer, so you will be able to use it for many applications.



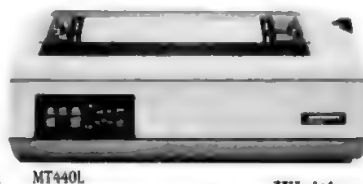
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COLOR THEM USEFUL

This year's crop of color printers is good enough to make you believe this breed is here to stay. What was once considered a fashionable electronic toy is becoming an accepted business tool for use by major corporations.

The color printers we reviewed fall into two categories: impact and ink jet. While

the various ways of using the two technologies overlap, your choice should depend on what you intend to do with the printer and on how much you are willing to spend.

Each printer tested has bright spots as well as faults. What can be forgiven in a \$700 printer may not be acceptable in a printer costing twice as much. In selecting the editor's choices, we weighed this against each printer's good and bad points and found that most of the printers have established a niche in this fast-growing market.

Canon PJ-108A

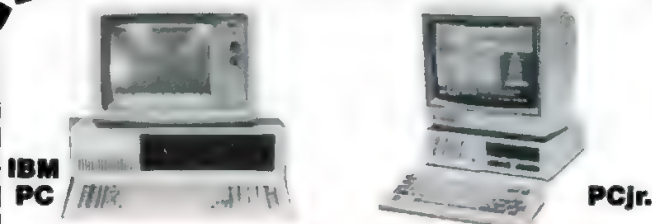
If you mainly want to produce color graphics for presentations, an ink jet printer is for you. And for as little as \$795, you can purchase the Canon PJ-1080A printer. It will produce crisp-looking screen

dumps from your PC, and the software is provided by Canon. Moreover, any of the Canon ink jet printers marketed by other companies can do the job for about the same price, so if applications software for another brand is more readily available to you, you should buy your printer based on this availability.

Diablo C-150

If you require higher-quality ink jet color graphics and plan to use your printer for occasional letters with some graphics mixed in, then the Diablo C-150 may be a better choice. This is a nice dual-purpose printer if you can deal with the installation problems and have ready access to its paper and ink supplies.

For faster output speeds, you have to look at impact matrix color printers. They are louder than ink jets but are also faster



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IBM-TVC	PCjr. Connector for TV.	\$ 29.95
IBM-CPR	PCjr. Compact Printer.	\$169.95
IBM-CPC	Compact Printer Adapter Cable. (Needed for Printer operation)	\$ 39.95

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IBM64K0	System Unit w/64K—No Drives.	\$1195.00
IBM256K2	System Unit w/256K—2 (360K) Drives.	\$2149.95
IBMPC-XT	PCXT System 256K with 8 Slots & Async Card.	\$3799.95
IBMDOS2.1	Disk Operating System Software.	\$ 59.95

Monitors

IBM-MGM	IBM Monochrome-Green-Monitor.	\$259.95
IBM-RGB	IBM Full Color RGB Monitor.	\$599.95

Cards

IBM-MC	IBM Monochrome Card (Plus Printer Port).	\$224.95
IBM-CC	IBM Color Card.	\$229.95

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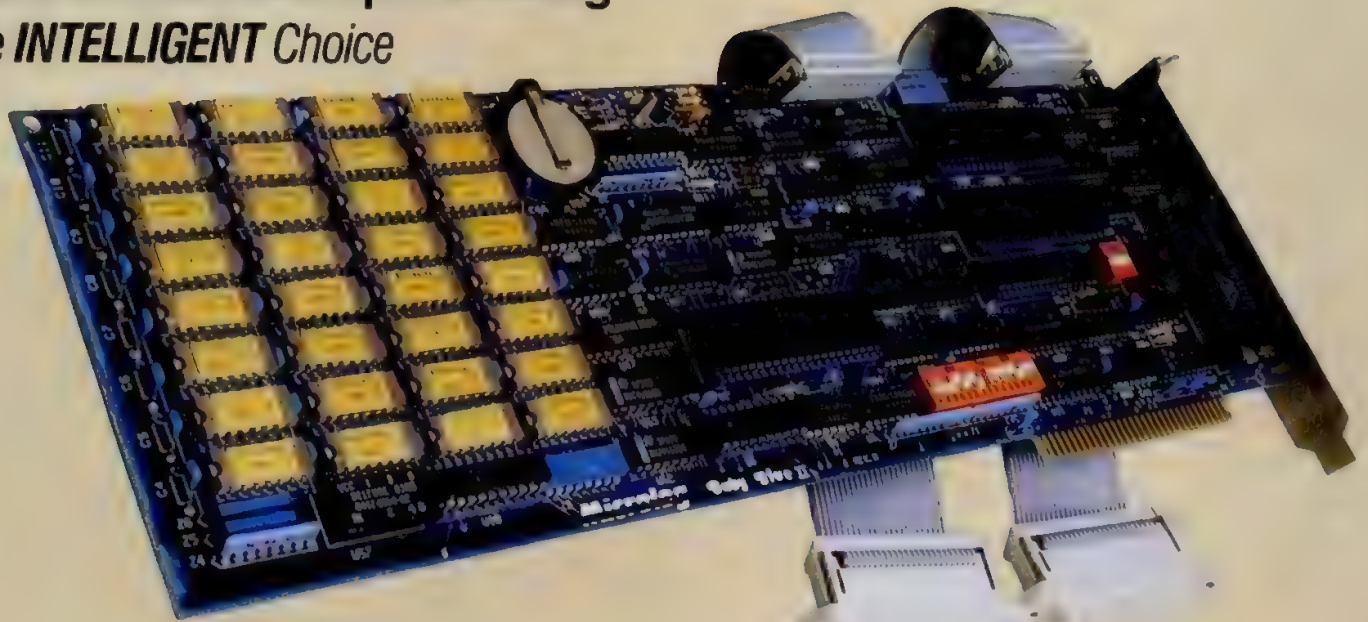
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● CP/M Capability:

Baby Blue II offers instant access to the vast CP/M-80 library of mature, professional software for every conceivable application.

● Dual Ported Memory and I/O:

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All this and SOFTWARE too . . .

Systems utilities

PDO RAMdisk Software: create a FAST pseudo-disk drive of any size in available system RAM. The DOS 2.0 version lets you change the size of your RAMdisk from the keyboard.

Print Buffer/Spooler: a TRUE print spooler: the Z-80 buffers and manages printing independent of your PC. Unlike other so-called "spoolers", this one won't stop your printer or slow you down when you start another job.

Clock Software: sets Baby Blue II's clock and initializes the system clock at boot time—never type the time and date again!

Communications

Smart Terminal Emulator Package (STEP): talk to other microcomputers or connect to larger host computers, as an asynchronous terminal through Baby Blue II's serial ports. Unlike other "smart terminal" programs, STEP offers full emulation of popular video display terminals (the standard package includes Televideo 950 and Hazeltine 1500).

IBM 3101, DEC VT100 and many others are optionally available). You can send or receive text files, and with STEP's unique Sessions Menu, changing your configuration is a keystroke away.

BSTAM File Transfer Utility: Transmit and Receive text, HEX, and binary files (including .COM files) without errors and without fuss. BSTAM is easy to use, with all configuration parameters handled transparently under STEP.

CP/M-80 compatibility

Baby Blue Conversion Software: Microlog's famous CP/M Emulator turns CP/M-80 programs into PC-DOS programs for fast, efficient execution on Baby Blue II. Completely transparent operation using standard PC-DOS commands—freely mix PC-DOS with CP/M programs and text/data files on the same PC-DOS disks.

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and more suitable for general-purpose word processing and other text use.

Anadex Color Scribe

If you want a fast, quiet color printer that has correspondence quality text output and outstanding color, the best impact printer on the market is the Anadex Color Scribe (DP-9725B). It comes with screen dump software that quickly prints color graphs, offers 16 different color control codes for mixing color in your documents, and lists for only \$1,625.

The only bad mark we give this printer is for its size. Since it is built like a Sherman tank for effective soundproofing, it won't fit on your desk. But it is the quietest of all the color impact printers we tested. If you need one printer for all your office needs, this is the one to buy.

IBM Color Printer Dataproducts 8051

For software compatibility, you can go with Big Blue's Color Printer. Although it's nothing to write home about, it will certainly be picked up by most software houses; it is already supported by many graphics programs. You can perform screen dumps by using the PC-DOS 3.0 GRAPHICS.COM command.

Also check out the Dataproducts 8051. It's fully IBM-compatible—a Dataproducts' representative admitted that it is the IBM printer. It has no DIP switches because its printed menus do the job better, looks nicer, is easier to load paper into, and costs less than the IBM. Both printers are slow and have high-noise levels, but they also both do a credible job.

Epson JX-80

For the price of the IBM/Dataproducts printer, you can get two Epson JX-80's. Basically, Epson took the FX-80 printer, installed a decent paper-feed mechanism, quieted it down, and gave it color. It's still a bit slow, but its text looks better than the FX-80, and you can easily specify seven colors for printing. Its color graphics look good, although it does not come supplied

with any software for color screen dumps and won't work with the DOS 3.0 GRAPHICS.COM command. However, as for the IBM printers, software support

for this printer will surely be added in most graphics packages. It's not the best color printer on the market, but for general-purpose use, it's a competitor. ■

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CIRCLE 223 ON READER SERVICE CARD

SPECIAL ISSUE • COLOR PRINTERS

Manufacturer	Model	Print Technology	Price	Made In	Print Size (inches)	Resolution (dots/inch)	Rated CPS	Print Speed (pages/min)	CPS Quality
Seikosha	GP-700	Matrix	\$599	Japan	4.5x17.7x12.6	11.0	50	22.1	N/A
Radio Shack	CGP-220	Ink jet	\$699	Japan	4.3x15.8x11.6	12.3	37	20.0	N.A.
Epson America, Inc.	JX-80	Matrix	\$749	Japan	4.5x13.6x17.4	16.5	160	71.9	47.9
Canon	PJ-1080A	Ink jet	\$795	Japan	4.3x15.8x11.6	12.3	37	22.7	12.7
Quadram Corp.	Quadjet	Ink jet	\$895	Japan	4.3x15.8x11.6	12.3	40	22.7	13.1
Integrex Corp.	Colorjet 132	Ink jet	\$895	Japan	4.3x15.8x11.6	12.5	40	21.9	N/A
Diablo Systems, Inc.	C-150	Ink jet	\$1,250	Italy	6.1x20.9x13.7	24.2	20	13.6	7.8
Tektronix, Inc.	4695	Ink jet	\$1,595	Japan	6.0x19.9x13.7	24.3	20	15.1	N/A
Anadex	DP-9725B Color Scribe	Matrix	\$1,625	USA	8.5x27.8x16.4	40.0	240	98.7	59.5
Dataproducts	SPG 8051	Matrix	\$1,895	USA	9.4x24.2x13.8	40.0	200	98.6	20.3
IBM Entry Systems Division	Color Printer	Matrix	\$1,995	USA	10.0x22.8x14.0	40.0	200	86.3	12.7
Advanced Matrix Technology	AMT Office Printer	Matrix	\$2,200	USA	7.2x23.0x18.5	45.0	250	111.4	37.1

Manufacturer	Model	Print Technology	Print Size (inches)	Print Speed (pages/min)	IBM PC Compatibility	Print Speed (pages/min)	Print Speed (pages/min)
Seikosha	GP-700	N/A	1/120	FL	L	—	—
Radio Shack	CGP-220	N/A	1/8	AC	L	G	Canon PJ-1080A
Epson America, Inc.	JX-80	N/A	1/216	FL,DL,AC	L	D	Epson FX-80
Canon	PJ-1080A	N/A	1/8	FL	L	V	—
Quadram Corp.	Quadjet	N/A	1/8	FL	L	V	—
Integrex Corp.	Colorjet 132	1/120	N/A	FL,AC	L	V	Canon PJ-1080A
Diablo Systems, Inc.	C-150	N/A	1/6	—	L	D	—
Tektronix, Inc.	4695	N/A	N/A	—	L	G	—
Anadex	DP-9725B Color Scribe	1/90	1/72	AF,FL	L,H	V	—
Dataproducts	SPG 8051	1/120	1/144	FL	L,H,C	D(3.0)	—
IBM Entry Systems Division	Color Printer	1/120	1/144	FL,AF,AC	L,H,C	D(3.0),V	—
Advanced Matrix Technology	AMT Office Printer	1/120	1/48	DL,AF	L	G	Diablo, Qume, NEC

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters;

Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
N/A	60.0	72.0	71.5	UT,RSS	R,B	9.5	5,10,13,3	—	LH,FL
N/A	N/A	64.0	63.0	UT,RSS,RP	R	9.5	5,10	—	LH,FL,HT
Emphasized	50.0	71.0	70.0	UT,RSF	R	9.5	5,8,5,10,12,17	H,V,U,S	P,LH,FL,HT,VT
Boldface	<50.0	<60.0	<60.0	RSS,RP	R	9.5	5,10	H,U	LH,FL,HT,VT
Boldface	<50.0	60.0	64.0	RSS,RP	R	9.5	5,10	H	LH
N/A	N/A	<60.0	<60.0	RSS,RP	R	9.5	5,10,12,17	H,V,U,S	P,FL,HT,VT
Unidirectional	61.0	68.0	68.0	RSS,RP	R	9.5	10	—	HT,VT
N/A	N/A	64.0	65.0	RSS,RP	R	9.5	10	—	—
Dual-pass proportional	<55.0	72.0	74.0	UT,RSS	R,B	15.0	5,9,10,12,16,4	H,C,U,S	P,J,C,V,HT,VT
Emphasized, double strike	65.0	73.0	72.0	BT,RSS,RSF(O)	R,F,B	15.0	5,10,12,16,7	H,C,U,S	P,LH,FL,HT,VT
Near letter quality, double strike	N/A	69.5	70.0	BT,RSS	R,F,B	15.0	5,10,12,17,1	H,C,U,S	P,J,LH,FL,HT,V
Letter quality	55.0	82.0	79.0	BT(O), RSS,RSF(O)	R,B	15.0	5,8,5,10,12,17	H,C,U,S	P,LH,FL,HT,VT

Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
0	C,CL	\$19.95	O,L,F	Fair	7	MP	B	No	1:1	72	Yes
80	I	\$14.95	O,FL,E,P	Excellent	7	7	A	No	1:1	72	No
2,048	C,CL	N/A	O,L,F,E,P	Good	7	MP	A	No	1:1	72/144	Yes
80	I	\$17.00	O,L,F	Excellent	7	7	A	Yes	1:1	72	No
0	I	N/A	O,L,F,E,P	Excellent	7	7	A	Yes	1:1	72	No
0	I	N/A	—	Excellent	7	7	A	Yes	1:1	72	No
4,096	I	N/A	F,E	Excellent	7	7	A	No	1:1	120	Yes
0	I	\$25/Color	O,L,E	Excellent	7	7	A	Yes	1:1	120	Yes
3,584	C,CL	\$18.00	O,L,F,P	Good	16	MP	B	Yes	1:1	72/144	Yes
5,120	C,CL	\$19.95	O,L,F,E,P	Good	4	MP	B	DOS 3.0	1:1	84/168	Yes
8,192	C,CL	\$15.95	O,L,F,E,P	Good	4	MP	B	DOS 3.0	1:1	84/168	Yes
8,192	C,CL	N/A	O,L,F,E	Good	4	MP	B	No	1:1	60/120	Yes

AF=Alternate fonts, AC=Alternate character set(s) IBM PC Compatibility: L=Low-order characters, H=High-order characters, C=IBM PC Graphics Printer command sequences Graphics Compatibility: D=PC-DOS graphics command compatible, (3.0)=DOS 3.0 required, G=Incompatible graphics, V=Vendor-supplied software for compatible graphics Ribbon or Refill Type: S=Spool, C=Cartridge, CL=Cloth, CA=Carbon, I=Ink jet refill, T=Thermal paper Front Panel Controls: O=On/Off line, F=Form feed, L=Line feed, FL=Combined form and line feed, E=Error message and correction, P=Power-on settings # Mixable Colors: MP=Multiple passes produce combinations Ribbon Colors: A=Process, B=Process or primary (O)=Optional

ADVANCED TECH PRINT:

In the course of this issue, I think we've seen at least one example of every different type of printer technology. Most of the machines are common pokers, bangers, or spitters (that is, impact dot matrix, daisywheel, or ink jet printers). While some of these show some remarkable improvements in the state of the art for their particular technologies, they all still use essentially the same old methods of putting dark marks on paper.

Two printers, however, represent genuinely different techniques for creating the printed word (or number or picture) with a microcomputer. Both use similar processes, and it is interesting to see how they work.

The Light Fantastic

The most dramatic "new" technology is that of the low-priced laser printer. Similar machines have been available for some time for \$10,000 or more, but now the same high-quality, high-speed printing is available for only \$3,500. The new lower price is made possible by the use of a laser "print engine" developed for Canon's low-priced Personal Copier.

All laser printers work on essentially the same principle, which derives from the process used in typical office copiers (thus the relation with the Canon copier). In a copier, bright lights shine on the original document, and lenses focus the negative image on a rotating drum. The drum is coated with a special photosensitive substance that loses its charge when it is hit by light. Thus, the drum remains charged wherever the light does not strike it. As the drum turns, it passes over a bin of oppositely charged toner particles. These, of course, are attracted only to the



charged parts of the drum; the drum rotates further, and the toner is deposited on the paper.

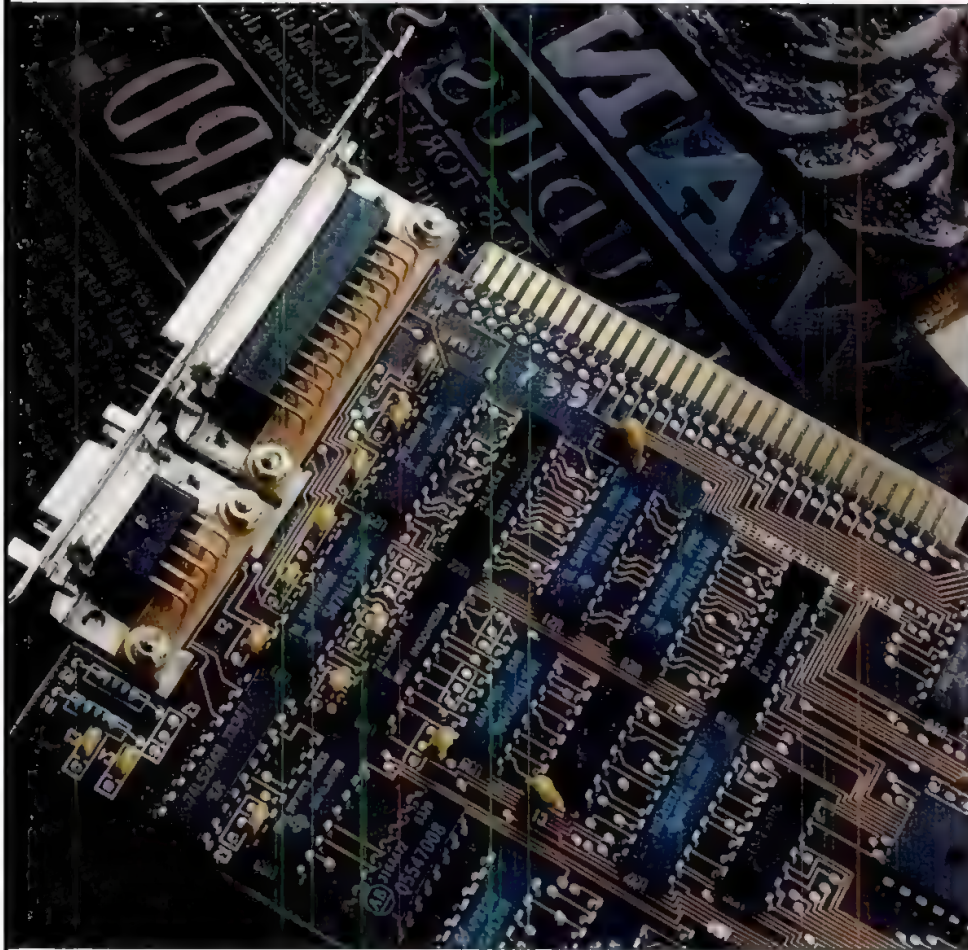
The paper is then fed through a heating unit that fuses the toner particles to the paper. Meanwhile, the drum continues to turn. Any remaining toner is cleaned off, and the original charge is restored. This section of the drum is now ready to accept a new image for printing.

A laser printer works in a similar way. Instead of a full image being focused on the rotating drum, the image is created dot by dot by a semiconductor laser. The laser

flashes on and off, and its light shines against a rotating, multifaceted mirror. The mirror reflects the light and plays it across the surface of the drum. The process of picking up the toner and fusing it to the paper is almost the same as with a regular copier.

A laser printer requires considerably more intelligence than a typical impact dot matrix or daisywheel printer. Since it generates images with extremely fine resolutions—300 dots per inch or better, both horizontally and vertically—it requires many more calculations to define the im-

SPEEDING AHEAD



Photograph: Les Morsillo

age. To accomplish this, a laser printer needs lots of memory, both ROM to store the different type fonts used and RAM to store the particular image to be printed.

Some laser printers have relatively limited memories and can produce only a few fonts and only certain types of graphics. Others may have a full megabyte of memory or more, enabling them to store many fonts and to generate graphics (including boxes and curves) from simple commands. A large memory lets a printer store full-page images and then combine them. Thus, you could combine a previ-

ously defined letterhead or form with text for a letter or invoice and have the printer produce a single document in just one step.

Thermal-Transfer Printers

The other new printer technology is thermal transfer. Traditionally, the thermal-transfer process involved selective heating of chemically treated paper so that small dots on the paper turned color. The paper is expensive, and the images tend to fade with age. A new wrinkle on the same idea puts the heat-sensitive material on a

IN THIS SECTION

Hewlett-Packard
LaserJet
Diablo Systems, Inc.
EPM-1

ribbon, and the printhead "melts" the dots of ink onto the page. The old approach produces print of the same quality as an impact dot matrix printer; the new approach is comparable to a laser printer.

Thermal-transfer printers use a special film (much like a sheet of carbon paper) that is fed through the printer along with the paper. As it passes over a heating element, tiny portions of the heater turn on and off. This melts the ink on the film and deposits it on the paper.

This process permits extremely fine resolution and prints a variety of fonts and graphics. The thermal-transfer process appears to be a bit more temperamental than laser printing; however, and the print quality does not seem to be quite as good.

A Wider Choice

So now, in addition to the old bangers, pokers, and spitters, we have zappers and bakers too. While these advanced-technology printers are still relatively expensive, they offer advantages not available from more traditional technology. Laser printers are especially attractive. While the choices are limited at this point, there should be at least half a dozen more low-cost models to choose from by this time next year.

It's hard enough already to choose a printer, and it looks like it's not going to get any easier. ■

Hewlett-Packard LaserJet

Dear Santa,
"I've been looking at stacks of computer printers and have finally found the one I want, the Hewlett-Packard LaserJet. Come December 25th, that's all I want; give someone else my ties this year. P.S. I've made all my article deadlines for the past 12 months."

If that doesn't work, I just might go out and buy one myself! This machine is one of a new breed of laser printers based on the Canon personal copier print engine. Now you can buy a laser printer for the price of a top-quality daisywheel printer.

There is no competition between these two types of printers. To start with, the LaserJet's characters are formed using 300-dots-per-inch, making it nearly impossible to tell the difference between laser print and fully formed type. The letters are crisp, and there are no "jaggies"

on the curved lines. Optional ROM cartridges let you select from a wide range of fonts, including proportionally spaced characters. You can even mix type styles and sizes on a single line—it's easy to drop in an italicized word, for example. Your pages come out looking like they were professionally typeset, rather than a mere computer printout.

As for speed, the LaserJet puts out eight pages per minute. And, whether you have 1 character or 2,000 on the page, it takes just 7½ seconds to print. If you figure 66 lines per page, this adds up to more than 500 lines per minute. Most daisy-wheel printers can manage only one-tenth that speed.

True, the test results show only 177 lines per minute for the two-page sample printout. However, this is because the LaserJet waits 18 seconds before starting to print the first page. Therefore, the longer your print run, the closer the LaserJet will approximate the 500-line-per-minute figure.

Hewlett-Packard rates the LaserJet's noise level at less than 55 decibels when printing, and less than 45 when on standby. This is lower than PC's tests were set up to measure. No matter what the actual figures are, it's significantly quieter than any daisywheel printer.

The print cartridge refills are a steep \$99 each. However, since each cartridge is good for about 3,000 pages, the cost per page is on a par with daisywheels using multistrike ribbons. (Don't try substituting the less-expensive Canon personal copier cartridges; they're not exactly the same.)

The LaserJet requires no scheduled maintenance because each new cartridge replaces the image-processing section of the printer. This means you can expect consistent print quality. Other nice features include its relatively small size (28 inches by 18½ inches); graphics capabilities, with up to a 59K data buffer; and its ability to print on a variety of papers or transparencies, including letter-size and legal-size sheets, and even envelopes.

One of the LaserJet's few annoying



LaserJet
Hewlett-Packard
11000 Wolfe Rd.
Cupertino, CA 95014
(800) FOR-HPPC
List Price: \$3,495

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using the Power On Default feature(s).

using the Underline feature(s).

using the Bold Print feature(s).

drawbacks involved the convoluted escape sequences needed to select different fonts. These sequences can run as long as 31 characters. I didn't have enough time to decipher what these control sequences meant, so I don't know if there are ways to reduce the number of command characters required. You could probably build some batch files to handle the configuration tasks.

Graphics are possible, but not easy. Hewlett-Packard supports screen dumps for its HP-150 computer, but not the IBM PC. It has no plans for producing a graphics driver for the LaserJet with the PC. Perhaps a third party will fill this gap.

Hewlett-Packard does provide details on how to use the escape sequences for a variety of programs, including *WordPerfect*, *Multiplan*, *Volkswriter Deluxe*, *PFS: REPORT*, *MultiMate*, *WordStar*, and *1-2-3*. Note that *1-2-3* won't give you a screen dump of the graphics or let you use the PRINTGRAPH command with the LaserJet.

The LaserJet comes only with a serial interface. Normally, I cringe whenever I encounter a "standard" serial interface, but Hewlett-Packard has at least done the job right. Not only was I able to set it up and run a test print in 5 minutes, but the company even gives you MODE commands to set your PC so that it thinks the LaserJet is on your parallel port. Everything worked fine the first time.

I could go on and on about this printer. LaserJet sets new standards for print quality, speed, and quiet operation. Once Hewlett-Packard makes its graphics capabilities easier to use, it will be downright irresistible. —Alfred Poor

Diablo EPM-1

The Diablo EPM-1 was one of the more interesting printers reviewed for this project. Unfortunately, interest does not necessarily indicate practicality.

The EPM-1 is a thermal transfer print-

er, which means that the printhead applies heat to a film that leaves a mark on the page. This technique has more in common with laser printers than with daisywheel machines, yet Diablo has chosen to implement the escape sequences of the latter. The EPM-1 has a special mode that allows it to print raster graphics, actually a bit-mapped image of the printed output. This feature allows you to print proportionally spaced characters and different fonts and type styles.

Two aspects of this device disturbed

me. First, the print quality wasn't very good. The characters had extraneous dots and lingering lines that made them hard to read. Second, the machine prints a border that requires your word processor to leave a few extra blank lines at the top and bottom of the page and a few extra spaces inside the left-hand and right-hand margins. This renders the EMP-1 virtually useless for printing DOS screens with the Shift-PrtSc command.

Even more disturbing than these inconveniences was Diablo's lack of customer



EPM-1

Diablo Systems, Inc.

901 Page Rd.

Fremont, CA 94537

(415) 498-7000

List Price: \$3,995

CIRCLE 772 ON READER SERVICE CARD

using the Power On Default feature(s).

using the Times Roman Bold 10 point feature(s).

						(pounds)	Printer CPs		CPs Quality
Hewlett-Packard	LaserJet	Laser	\$3,495	USA	11.4x18.5x28.2	71.0	8 PPM	123.3	123.3
Diablo Systems, Inc.	EPM-1	Thermal Transfer	\$3,995	USA	12.2x30.0x21.3	88.0	6 PPM	57.0	N/A
							Paper Feed		
Hewlett-Packard	LaserJet	Times Roman 10 Pitch Medium	<55.0	<60.0	<60.0	SF (no roller)	Sheet hopper	8.5	
Diablo Systems, Inc.	EPM-1	N/A	<55.0	64.0	65.0	SF (no roller)	Sheet hopper	8.5	
		Type Pitches	Printing Features	Formatting Features	Smallest Horizontal Increment	Smallest Vertical Increment	Alternate Characters		
Hewlett-Packard	LaserJet	10,12,16,6	C,U,S	P,LH,FL,HT, VT	N/A	1/48	FL,AF,AC		
Diablo Systems, Inc.	EPM-1	5,10,12,17	H,V,C,U,S	P,J,HT,VT	1/2030	N/A	Unlimited		
		IBM PC Compatible			Ribbon Type or Refill Cost	Ribbon or Refill Cost	Front-Panel Controls		
Hewlett-Packard	LaserJet	L	G	—	57,344	Copier cartridge	\$99.00	O,F,E	
Diablo Systems, Inc.	EPM-1	L	G	Diablo 630	65,536	Ink donor film	N/A	O,F,E	

Paper Feed: UT=Unidirectional tractor; BT=Bidirectional tractor; RSS=Roller, single sheet; RSF=Roller, sheet feeder; PFR=Pin-feed roller; RP=Roll paper. **Paper Source:** F=Front; R=Rear; B=Bottom. **Printing Features:** H=Horizontal emphasis; V=Vertical emphasis; C=Correspondence quality (matrix); U=Underline; S=Sub/Superscript; R=Red ribbon. **Formatting Features:** P=Proportional spacing; J=Justified lines; C=Centered lines; LH=Variable line heights; FL=Variable form length; HT=Horizontal tabs; VT=Vertical tabs. **Smallest Horiz. Increment:** If printer has proportional spacing, N/A=Information not available. Otherwise, N/A=Not applicable. **Smallest Vertical Increment:** N/A=Not available. **Alternate Characters:** FL=Foreign language; DL=Download characters; AF=Alternate fonts; AC=Alternate character set(s). **IBM PC Compatibility:** L=Low-order characters; H=High-order characters; C=IBM PC Graphics Printer command sequences. **Graphics Compatibility:** D=PC-DOS graphics command compatible; (3 0)=DOS 3.0 required; G=Incompatible graphics; V=Vendor-supplied software for compatible graphics. **Ribbon or Refill Type:** S=Spool; C=Cartridge; CL=Cloth; CA=Carbon; I=Ink jet refill; T=Thermal paper. **Front Panel Controls:** O=On/Off line; F=Form feed; L=Line feed; FL=Combined form and line feed; E=Error message and correction; P=Power-on settings. **Mixable Colors:** MP=Multiple passes produce combinations. **Ribbon Colors:** A=Process; B=Process or primary. (O)=Optional.

support. When I could not get the printer to operate immediately, I placed a call to Diablo's Technical Support "Hot Line." Apparently the heat went out of this service some time ago. Not only did I have to listen to a taped announcement, the answering machine would not even take a message! Maybe Diablo wants to save money on telephone bills by cutting out

returned calls. Anyway, the taped voice suggested I call back during nonpeak hours, which I did. Thank goodness *PC Magazine* was paying for these long-distance calls. On my second and third attempts, I heard the same tape. Finally, I called the vice-president of marketing, whose secretary connected me to a helpful engineer. Luckily, I was not an anonym-

ous end user, or I might never have received assistance.

The EPM-1's strong points, especially speed and lack of noise, do not outweigh its weak points. And Diablo's support, or lack of it, makes this printer a poor choice for end users. I hope that printer vendors will start to remember what the *P* in PC stands for.—**Bill Harts**

LASERS LEAD THE WAY

Selecting the best printer in the Advanced Technology category means first selecting the best technology, and that's simple to do. The two technologies tested are laser and thermal transfer. Although both produce excellent quality printing, the laser is simpler to use and may be more cost effective.

The laser is simpler because maintenance requires no more than replacing a disposable copier cartridge, whereas thermal transfer maintenance requires replacing an unwieldy role of donor film. As for cost-effectiveness, the laser printer tested was less expensive than the thermal transfer model (there are more-expensive lasers and much less-expensive thermal transfer models coming on the market), and it could do more than the thermal transfer printer with less difficulty.

Having said all that, the choice in this category is clearly the Hewlett-Packard LaserJet. Since no other laser printers were successfully tested, there was really no contest. Even so, it's hard to imagine anyone beating the H-P's price/performance ratio. Let's just call it the best printer reviewed in this issue.

Consider a printer that makes almost no noise in standby mode and only slightly more as it prints. It zips along at a print speed of 120 cps (eight pages per minute) or more. It prints in flawless letter quality fonts, comes standard with Courier 10 pitch, and has half a dozen other fonts available (including roman, italic, and

bold proportional fonts). It even has graphics capabilities.

This marvelous machine is based on the Canon laser printing engine. There

have been laser printers before, but at \$3,495, this one costs a third as much as its nearest competitor. Before you blanch at the price, remember that just a few years

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ago people were gladly paying that much for 50-cps daisywheel printers.

The LaserJet is a dream to set up. Although it requires a serial interface (which I generally enjoy about as much as a tax audit), all the factory settings worked the first time. It takes up no more desk space than most printers, and it can handle cut-sheet paper, letterheads, envelopes, and even transparencies with aplomb. There is only a brief warmup period, and then you're off, printing page after page of typeset quality documents.

It does have some drawbacks. You *must* use single-sheet paper; the printer can't handle fanfold paper or multiple-part forms. The command sequences are cumbersome, but the manufacturer provides instructions for configuring a variety of popular programs to take advantage of the LaserJet's different features.

Some people don't like the printing from the LaserJet because it is almost *too* good. Since it uses a process similar to a copier, the result looks as if it had been copied. You might find this undesirable for business correspondence. One person said he thought a letter that looked typeset, even if it were personalized, might seem too much like preprinted junk mail and be discarded. I can understand this point of view, but I don't agree with it.

Perhaps the LaserJet's biggest flaw is that, while it has great graphics capabilities, H-P has not yet provided a graphics driver for the IBM PC. There is one for the company's own touch-screen HP-150 MS-DOS computer, so perhaps you won't have to wait too long for a PC version. Until then, unless you are really into programming, you probably won't be able to use the LaserJet's graphics capabilities.

Eventually, however, you may be able to create letterheads, logos, and signatures and drop them into your printed pages.

The LaserJet's period of dominance may be short. This is the first machine based on the Canon laser print engine to hit the market, and it is certain that others will soon follow. You can expect to find a range of features, and prices, to choose from in the coming year. Already I have seen the LaserJet discounted to below \$3,000, and, as competition heats up, I expect to see prices pushed even lower.

For now, however, the LaserJet is a star, and rightfully so. It is strong, silent, and handsome in looks and output. With its *Star Wars* technology at a reasonable price, it quietly towers above the noisy crowd of conventional printers. Just remember that it may find its lonely peak crowded with competitors before long. ■

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PUT A BETTER FACE

By learning your printer's ASCII codes, you can program it to use all its features, even if your software doesn't support your machine.

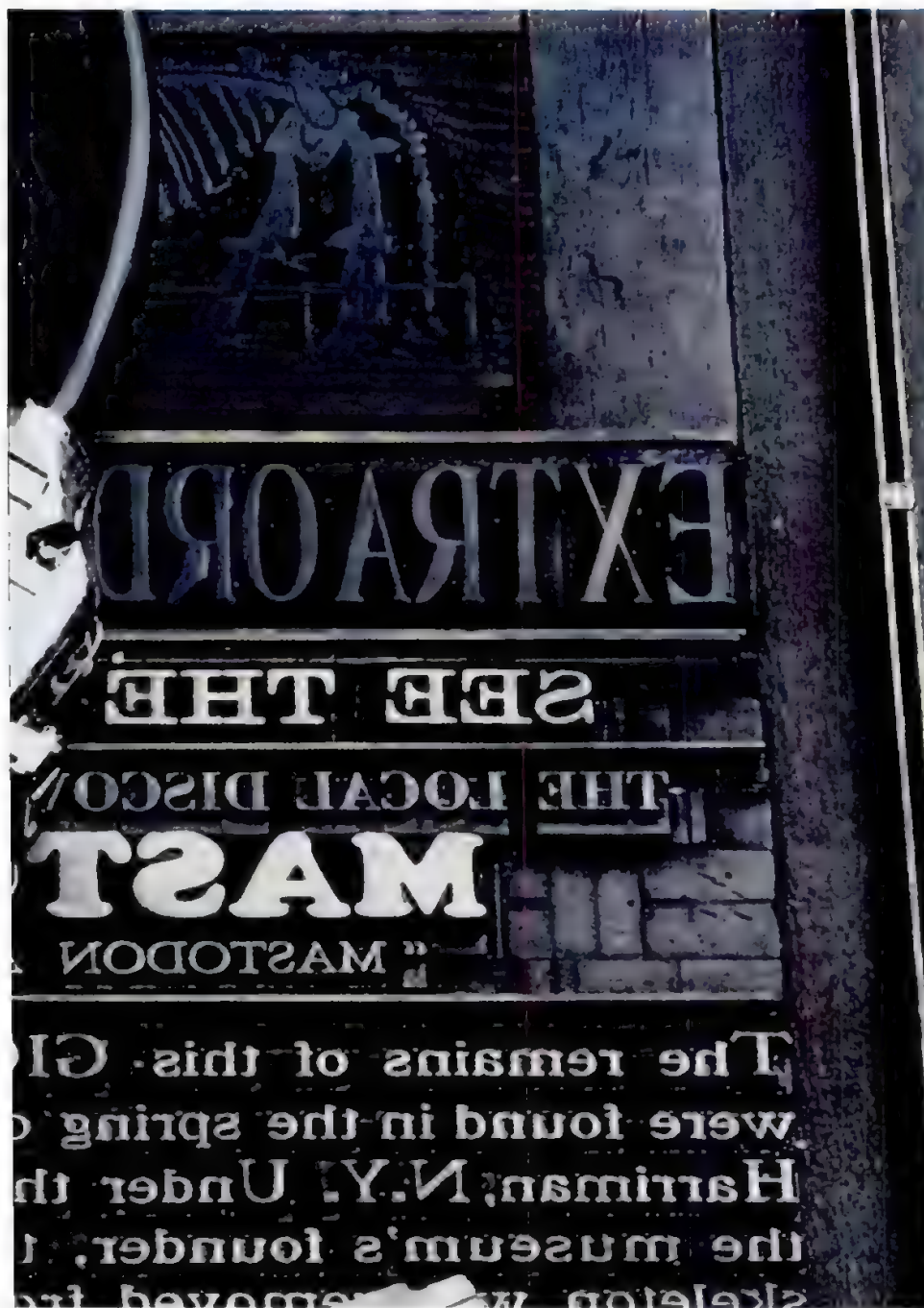
Imagine that you had a car, and all you ever did was drive it. "So what?" you may ask; "that's what it's for." But, suppose you never even turned on the lights or the radio, or adjusted the seat, or used the windshield wipers. You would probably agree that you weren't making full use of your investment.

That's probably what's happening with your printer. If you are like most PC users, you have at least one printer attached to your computer. Often, it's your most expensive peripheral. Yet all you do with it is print letters and numbers. You're probably thinking, "Just letters and numbers? What else am I supposed to do with a printer?"

Most printers can do much more than simply print one type of letters and numbers. They have small, specialized computers built in to them, and they are often referred to as intelligent. Many dot matrix machines can print expanded and compressed type, different pitches, and emphasized modes that produce boldface text. Some dot matrix printers also print screen dumps of IBM PC graphics. Daisywheel printers offer some options, including different pitches, boldface, shadow print, and proportional spacing. If you can learn how to harness the power of your printer's different features, you will



ON YOUR PRINTER



get much more value from it.

A Standard Language

The world of computers holds too few examples of common standards. One of the most prevalent, however, is ASCII (the American Standard Code for Information Interchange). ASCII is a way of assigning numeric values to the letters of the alphabet, the ten digits, and different punctuation marks. There is even a code for a space (since a printer must know when to leave a space between words). Since both microcomputers and printers understand ASCII, a printer can receive a string of ASCII characters from a computer and transform it into letters and numbers on paper.

Checking the Table

You'll find a table of ASCII values in the back of most computer and printer manuals. Since the standard ASCII code is based on seven bits (or a seven digit binary number), there are places for 128 different characters. This is more than enough for the letters and numbers and punctuation. How are the rest used?

The answer goes back to the origins of ASCII. It was designed for use with teletype machines, and, as a result, many of the extra characters were assigned to control the flow of information. These include line feed, form feed, and carriage return.

These special control characters fall in the beginning of the ASCII table. Note that there are different ways to refer to an ASCII character. The code for the capital letter A has a binary number of 1000001. In hexadecimal (base 16), the code for A is 41, whereas in decimal, it's 65. (The decimal values are perhaps the easiest for most people to work with, so I'll use them

Photograph: Les Menillo

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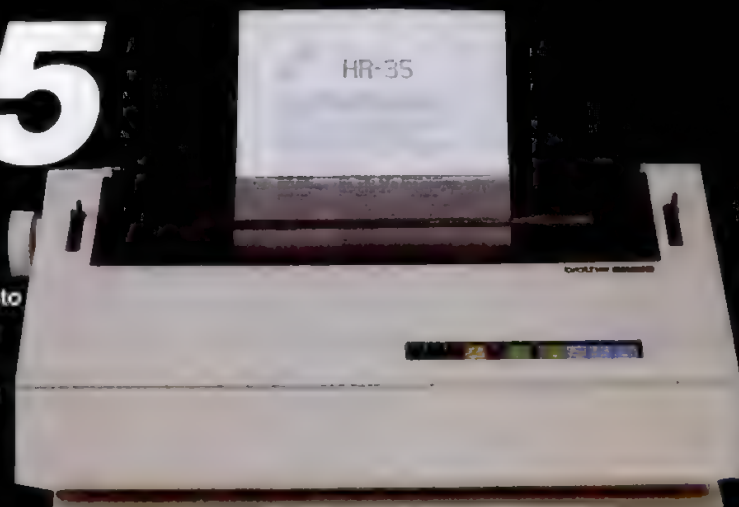
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ed and double-pressed
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you type

INT CHR\$(65)

and press the Enter key, your printer should respond by printing a capital A. Substituting CHR\$(12) should send a form feed code to your printer, ejecting the page. Trying CHR\$(7) ought to make your printer beep.

ASCII 27 is the escape character. Most printers treat this character as a special signal. It means that the next character is not to be printed, but instead dealt with as a command. In general, these "escape sequences" are the key to unlocking your printer's special features.

Unfortunately, this is the end of the line for standards in the printer world. Not all printers react the same way to the same escape sequences. I will use the Epson MX-80 with Grafrax as a standard since many other printers use the same codes. Of course, many printers don't use these codes. Check your manual before trying the examples presented here.

When you first turn to your manual, you may not be able to decipher it. Printer manuals tend to be hard to love. Sometimes they are poor translations from another language, such as Japanese. One printer's manual didn't even bother to translate the function names from the original German.

Aside from the language problems, printer feature commands are too often arranged by ASCII code values instead of

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PCM

PUT A BETTER FACE

by function. Thus, many manuals mix font commands with line spacing and tab settings. You may find it useful to create a "crib card" that reorganizes the commands in a more useful order.

You can use BASIC to try out some of the different features. For the Epson, Esc-G turns on the double-strike mode, and Esc-H turns it back off. Test this by typing the following:

```
LPRINT 'This is normal
type.'
LPRINT CHR$(27)+'G'
LPRINT 'This is
double-strike.'
LPRINT CHR$(27)+'H'
LPRINT 'This is normal
again.'
```

Note that CHR\$(27) is the escape code, since decimal ASCII 27 is escape. ASCII 71 and 72 could have been substituted for the *G* and the *H* since decimal ASCII 71 is the capital *G*, ASCII 72 is *H*.

Some features do not require an escape to turn them on. Decimal ASCII 14 is the SO (shift out) character, and, on the Epson, this enables the wide-character mode. You must send a DC4 (decimal 20) to disable the feature. To see what I mean, enter the following:

```
LPRINT 'Normal text'
LPRINT CHR$(14)
LPRINT 'Wide text'
LPRINT CHR$(20)
LPRINT 'Normal again'
```

You can use this technique to test out the different features of your printer. Some dot matrix printers have an underline mode that underlines your text automatically. Other printers, especially daisywheels, backspace and then type an underline character. You can try this with the following commands:

```
LPRINT 'Here is an
underline.';
LPRINT CHR$(8) CHR$(8)
CHR$(8) CHR$(8);
LPRINT CHR$(95) CHR$(95)
CHR$(95) CHR$(95)
```

That program should cause the printhead to back up four spaces—the four CHR\$(8) statements each send one backspace command—and then print four underline characters using four CHR\$(95) statements. This same technique can overstrike any pair of characters. For example, you can combine the slash (/) and the zero (0) characters to form a slashed zero (Ø). Not surprisingly, this technique doesn't

work with all

Using these sequences, you can create attractive printed pages. You can combine some features using both expanded fonts. Try out emphasis, strike printing. I know a number of people who use a dot matrix printer to print head information on the top of the page using different sizes and shapes of characters and avoid paying the printing cost of a fanfold letterhead.

Make It Easy on Yourself

Of course, most computer users rarely sit down at their system and grind out letters and reports by assembling long sets of BASIC program lines. If you're like me, you rely instead on a word processor to handle the problems of manipulating the text and controlling the printout process. You can also use database management, spreadsheet, and other application programs.

The degree to which these programs help you take advantage of the printer's features depends on what type of "printer driver" the program has. A printer driver is that part of the program that controls the computer built into your printer. Some

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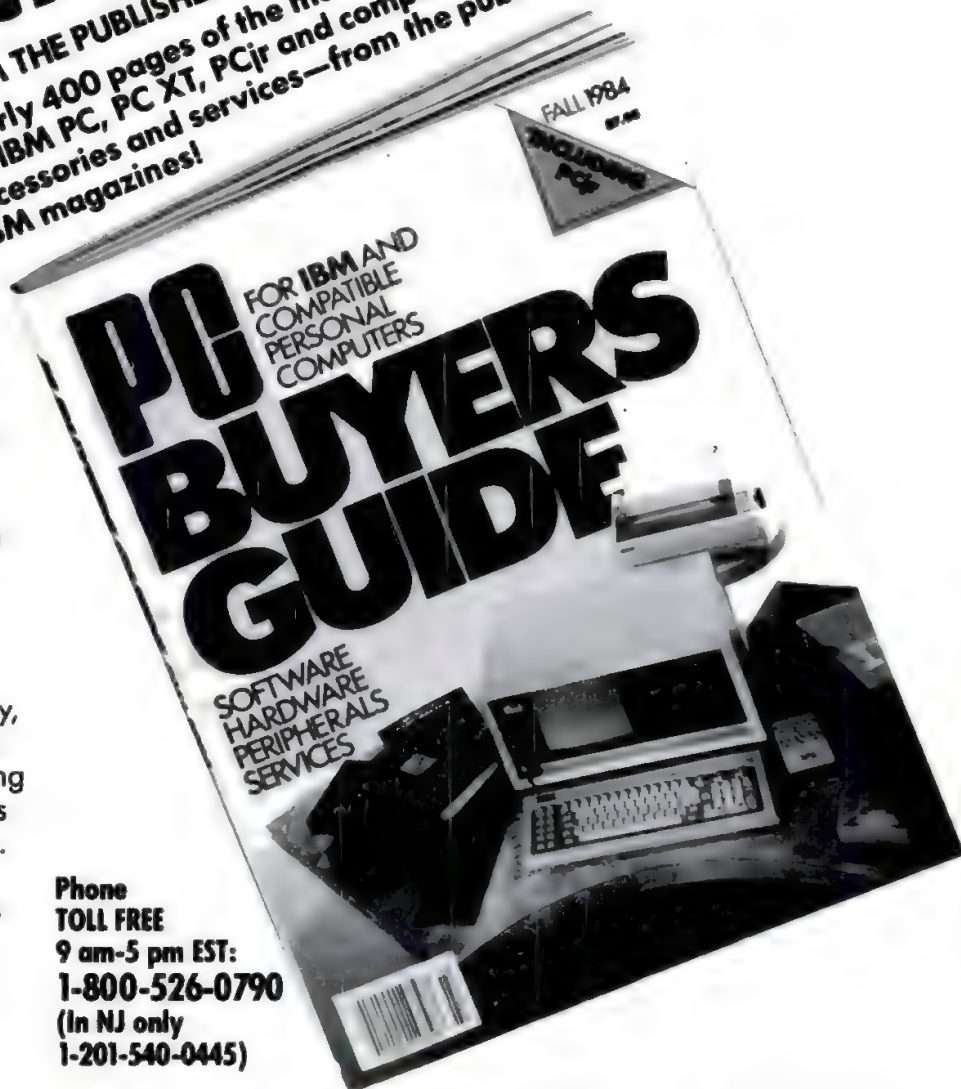
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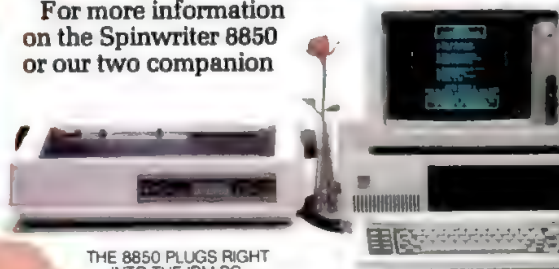
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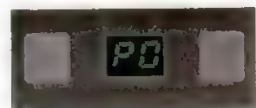
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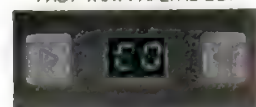
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In fact, several

PUT A BETTER FACE

printer drivers have more capabilities than others.

Some drivers merely assume that your printer accepts printable characters, spaces, carriage returns, and line feeds. They offer no opportunity for underlining, boldface, or other fancy features. More advanced printer drivers simulate the features of intelligent printers. Instead of sending a command to underline a set of characters, for example, these programs issue backspace and underline characters for each letter you want to underline (much as did the BASIC example above).

Some word processing programs allow you to imbed printer control commands, but this complicates the situation. This process requires you to remember the different command sequences and type them out each time. Furthermore, the programs can often get confused by the extra characters and end up not formatting the text properly.

The best programs take advantage of your printer's features with a minimum of effort on your part. These drivers insert the correct escape and other command sequences at the proper points to signal the printer to strut its stuff. All you have to do is tell the program when you want the

enhancement to start and stop.

Some programs achieve this end by containing a fixed set of drivers configured for specific printers. This approach means that you don't need to know anything about your printer's commands. The software manufacturer has already pro-

It always pays to try out all the features you want in a printer/program combination before you put down cash.

grammed all the necessary details for you. All you have to do is select the appropriate driver from the installation routine menu.

The fixed-set-of-drivers approach has two drawbacks, however. First, the software publisher may have selected a feature that you don't want and neglected one that you do. For example, the printer driv-

er may be set up to select double strike when you ask for boldface. If you think your printer looks better with emphasized print, you are out of luck. Worse yet, software programs can drive only a limited number of printers, and your printer may not be on the list.

The alternative is a data-driven printer driver. *EasyWriter II* is an excellent example of this approach. It presents a series of screens that allow you to specify the commands required to turn almost any feature you want on or off. If your printer doesn't have a certain feature supported by *EasyWriter II*, just leave that line blank. As a result, you can tailor the program to make full use of your printer. The only drawback is that you must first learn enough about your printer to make sense of the different commands.

No matter which type of printer driver your program has, it still may not be able to handle all of your printer's features. You may be able to send a signal to your printer that causes it to print proportionally spaced type, but your word processor may not be able to adjust for this, with the result that the lines come out unevenly, even when you specify left and right justification. It always pays to try out all the features you want in a printer/program



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The Big Picture

The only remaining issue is matrix-printer, dot-addressable graphics. There are two basic ways to get a graphic print-out. The first is to use the Shift-PrtSc combination for a screen dump of a graphics screen. Before this will work, however, you must load a graphics printer driver into your computer's memory.

IBM supplies just such a driver, GRAPHICS.COM, with DOS. This driver works with the IBM Graphics printer, as well as Epson printers with Grafrax. If your printer uses the same graphics commands as the Epsoms, then GRAPHICS.COM should work with your printer as well. If your printer isn't compatible, contact its manufacturer for help. Many companies now offer separate graphics drivers for their products at a modest, additional cost.

The other way to get hard copy of your graphics screens is to use a program that includes a printer driver. One example is the PrintGraph program Lotus built into 1-2-3, which lets you print out 1-2-3 graphs that you have saved.

PrintGraph uses the fixed set of drivers approach but covers many popular printers as well as a few plotters. If your printer has sufficiently fine resolution, it may even print higher-quality images than a screen dump can. Of course, you pay a price for this finer printing: you have to watch the printhead slowly creep down the page for up to half an hour for a single pie chart. Nonetheless, the results can be worth the wait!

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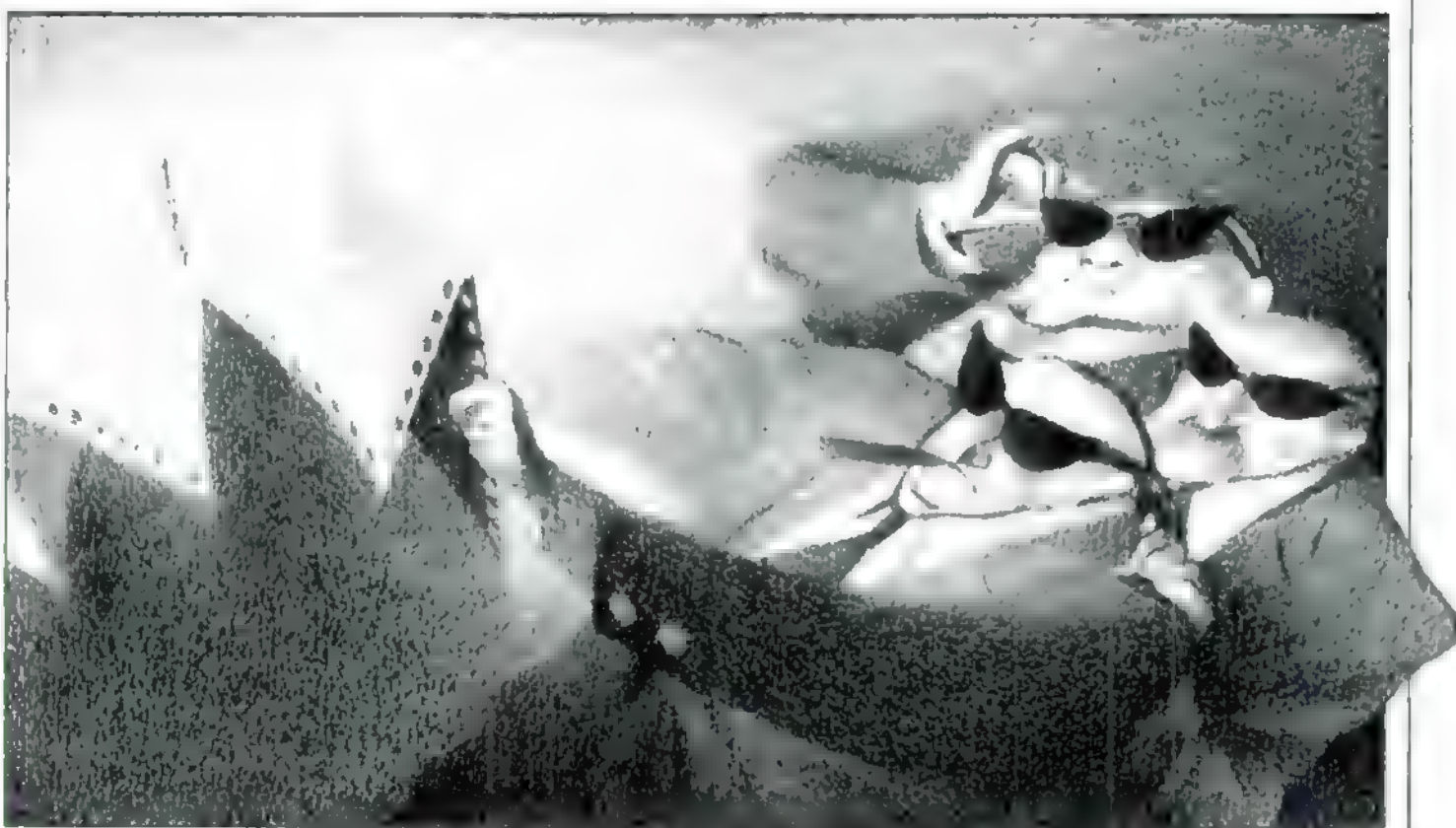
Just a few years ago, color printers were a rare and exotic breed. They were too expensive and complicated for the average small-business user and lacked support from the software industry.

Dramatic changes have taken place in the color printer world. Today you can get color hard copy for as little as 10 percent more than the cost of comparable black-and-white print. And these color printers are even easier to use than their predecessors. But now that affordable and usable color printers are available, what can they do for you?

Living with Color

As a child, I used color writing tools to express myself. Colored crayons of every hue seemed a natural way of communicating for me. My fascination with color continued right through my college years. To enliven my letters to friends back home, I experimented with color text and pictures. My friends loved the results, and soon they too were responding with color letters.

When I entered the business world I learned the hard truth: typewriters typed black. Color was impractical for business use—until the advent of PCs and low-cost color printers. When I bought my first PC a few years ago, I shrugged off the issue of color printer software



support and wrote my own programs to get back into the world of color printing. Then I faced the appealing challenge of finding business applications for my fancy output.

The simplest and most obvious use of a color printer, I found, is producing color text. If you highlight important phrases in color, the message stands right out. Color also is a natural for producing outlines: different colors distinguish the various levels of the outline.

While you could produce these effects by changing type styles, only a color printer can communicate emotions. A past due notice printed in red conveys anger. And purple implies royal treatment.

Emotions aside, a more obvious use of color printers is to produce color graphics. On charts, it is far easier to distinguish between items when they are printed in different colors rather than different patterns. Because of this, color in high-end computer presentation graphics has been common for many years. Although the quality of PC-color printer output is not yet up to pen plotter standards, it can generate, for presentations, acceptable overhead transparencies and graphics.

The true power of a color printer emerges, however, when you combine its graphics and text capabilities. Graphs are useful, particularly when placed in the middle of a letter or memo. Using

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BUSINESS

color you can let your printer print out your letterhead in its true corporate colors instead of fiddling with special paper. Proprietary software that lets you do these things now is available and affordable. When the job calls for graphics in your text, color printers are the solution.

Amid a pile of papers, a document with color is almost certain to catch the reader's eye first. If you want your memos read, color can help. Used selectively, color can also add nuances to the information. It's a natural for making that key message stand out or for lending

more clarity to your charts and graphs.

Color Gone Wild

However, like any powerful tool, you can overuse color to the point of making a good document nearly unreadable. When I first experimented with a color printer, I used color indiscriminately. I ended up with colors that dazzled the senses but were irritating to look at.

To use color wisely, it's important to understand the nuts and bolts of color printers. For starters, there are inherent drawbacks in the design of most color

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October 15, 1984

Mr. John Gettun
Vice President, Production
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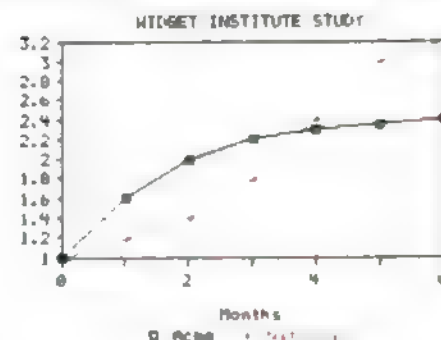
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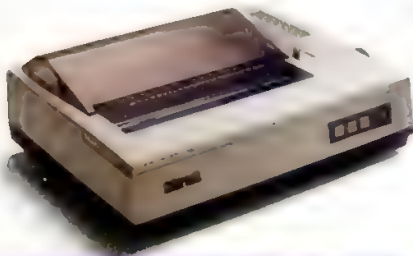


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printers. The printhead in a black ink printer distributes ink from a wide portion of the ribbon. With color impact printers, however, ribbon use is restricted to a narrow band of the ribbon, which causes color ribbons to wear out faster. With color ink jet printers, more inks can mean more ink tanks to run dry.

The most serious problem has to do not with the printer but with obtaining photocopies of the output. Color photocopiers are rare and expensive. If you want multiple copies of your color output, it is far less expensive to print them out yourself than to take them to a color copy center.

Be warned that if you photocopy color output on standard copier machines, the color differences will be reproduced in various shades of gray. However, on some copy machines certain colors, such as blue, are barely distinguishable or disappear altogether.

Although the main factor that determines the effectiveness of your output is intelligent use of color, most people spend more time learning how to change ink colors than developing good color writing style. Here are a few hints for adding color to your business life.

Conserve Your Colors

First, use color conservatively. Using too much color can make a document difficult to read and will distract the reader from the main point. The consistent use of colors is important. When the eye scans a document, it will try to tie together pieces with similar colors.

Select colors to match your audience and message. If your reader is conservative, stick to more subdued colors such as purple and magenta instead of cyan and red. If you are discussing a money-making opportunity, you may want to highlight it in green. Your colors can communicate as much as your words.

Reserve your most eye-catching color to highlight the main message. The reader's eye will focus on the vibrant color first. Don't waste that effect on anything

but your most important point.

Finally, don't hesitate to experiment with your color printer. Trial and error is the best teacher. ■

Mark Skiba is director of software development for the American Programmers Guild, Ltd.



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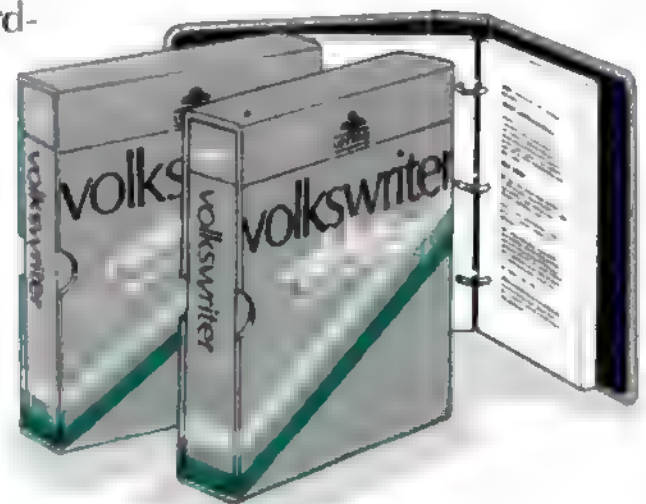
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PRODUCT REVIEW

Mini-Ledger

BY SAM PERKINS

Mini-Ledger just keeps getting better and, indeed, may now be setting the standard for the home computer market.

Since my first review of *Mini-Ledger* appeared ("Maxi-Value from a Mini-Ledger," PC, Volume 3 Number 1), Paradigm Consultants now has an updated Version 2.0.

In its original *Mini-Ledger*, I thought Paradigm had gone about as far as they could with a single-entry bookkeeping program without getting into complications that would make the program hard to learn.

If anything, this new version appears easier to learn and easier to use than earlier versions, in spite of its several new features. One of the main reasons earlier versions were easy to learn was because the program was written in such a way that it was not necessary for the user to know much about accounting. Essentially, if you could use your checkbook, you could use *Mini-Ledger*.

Checkbook Easy

The new version loses none of that simplicity and includes extensive on-screen help messages, in case you do forget what to do next. These messages are so comprehensive that they almost make the manual redundant. I say "almost make the manual redundant" because if you are completely new to computers and computer accounting, you should work through the exercises just to get a grasp of the major concepts.

One big improvement in the Version 2.0 manual is two sections at the back with good ideas of how to lay out your own chart-of-accounts. Following these are example lists of charts-of-accounts, perfect for people new to accounting in general, and to computer

accounting, specifically.

Data Input

The data input module of *Mini-Ledger* is still its core and its most sparkling feature. I don't think I've ever seen a program in which data entry was easier or faster. You make entries across the screen rather than down, which allows the program to keep much more data available on

having to re-type them.

New Features

In the first review, I did not think it was possible for *Mini-Ledger* to print a profit and loss statement because the program allowed the user to set up his chart-of-account codes any way he wanted them. That meant the program would have no way of knowing which codes were

* 3 - SORT A PAYCODE FILE *

- * Your codes can be sorted either numerically or alphabetically.
- * The program works better if your codes are sorted numerically.
- * You might want to sort them alphabetically so you can have two
- * printed lists, one alphabetically, one numerical. That will make it
- * easier to find things. Remember to sort them back numerically
- * when you are finished.
- * PRESS ANY KEY TO CONTINUE

DO YOU WANT TO:

- 1 - CREATE A NEW PAYCODE FILE?
- 2 - CHANGE AN EXISTING ONE?
- 3 - SORT A PAYCODE FILE?
- / or ? GETS HELP MESSAGE

the screen where it can be seen. Programs that force you to "fill out a form" down the screen almost always present you with a new, clean screen each time you store an entry, making it cumbersome to go back to previous entries.

Mini-Ledger's speed of input is enhanced because you can copy items from above with the tab key rather than

for income and which were for expenses.

Version 2.0 does print a profit and loss statement complete with percentages. It gets around the drawback of not knowing how you have set up your codes by asking you. The new manual recommends that you put your income codes at either the top or the bottom of your chart-of-

account code list. Then when you are printing a profit and loss statement, the program asks for your starting and ending income and expense codes, and assigns amounts accordingly.

I particularly like the new bank statement reconciliation feature because it works so simply. It is a two-step procedure in which you mark the checks and deposits that have been returned by the bank (two keystrokes) and then let the program do the rest. All you have to do is enter the ending balance shown on your bank statement and the program lists all unreturned items, totals them, and tells you what your final balance should be. If the balance it finds in your data is the same, you get a message telling you that your checking account balances. If not, you get a message telling you how much you are off.

Multiple Accounts

A minor drawback of the earlier *Mini-Ledger* was that it would allow you to keep only one checking account and one year of data on a disk. Version 2.0 keeps up to 50 months of data on a single disk, stored in the same account or in several different accounts. If you were using only one account, you could conceivably keep 4 years of data on line at all times, providing some interesting studies of patterns.

Version 2.0 of *Mini-Ledger* is a significant improvement in a program which I already strongly recommended. In the process of making it both easier to use and more useful, Paradigm has opened a new market: the home computer user. *Mini-Ledger* was originally aimed at the business community and nothing has been done that diminishes it in that regard. Now the help messages and the bank-statement-reconciliation process make it an ideal program for home use. And at \$150 it is one of the most underpriced programs on the market. ■

Mini-Ledger, Version, 2.0
Paradigm Consultants, Inc.
39243 Liberty Street
Fremont, CA 94538
(415) 796-0543 (800) 821-8407
List Price: \$150
Requires: 128K RAM

Accent on Type

Producing special characters with the PC is no longer a problem. Triad Computing's T³ word processing program lets you put away your Selectric print elements and create your own fonts.

Ma technical writer's best work often remains trapped within the PC. Foreign-language users who pepper their text with accents and umlauts and mathematicians who use Greek letters, subscripts, and superscripts find a gap between what they can produce on the screen and what they can print on paper.

Technical writers have always had to contend with special characters and elaborate formatting. The traditional solution has been to use the IBM Selectric typewriter, with its interchangeable elements and incremental spaces. But why juggle those metal golf balls when you could be clattering away at the PC keyboard?

The PC's extended character set, running from ASCII codes 128 through 255, has virtually every accented letter you



T³ Technical Word Processing System

Triad Computing, Inc.

1190-B Foster Road

Las Cruces, NM 88001

(800) TRI-ADT3

(505) 522-4600 in New Mexico

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could want, several Greek characters, and a few math symbols. They do not appear on the keyboard, but the Alt key permits you to enter them, if your word processor does not interfere.

If you hold down the Alt key and enter 224 on the numeric pad, the Greek letter alpha appears at the cursor position when you release the Alt key. With judicious use of the Alt key in combination with other keys, you can sprinkle your text with Greek characters, selected math symbols, and block graphics.

Unfortunately, only the IBM graphics printer and a few others can handle the PC's extended ASCII set. Other printers might generate a special character that

doesn't match what appears on the screen or reduce the extended ASCII code to the normal range.

And what about the many symbols IBM had no room for in its screen font, or the centered displays, rectangular arrays, and other formats needed in technical writing? You can draw them on the screen in graphics mode (if your system is suitably configured), but can you use them for word processing? Yes, if your printer supports either characters that you can download or dot graphics.

A dot matrix printer forms characters by striking a ribbon with little pins. If, for example, the printer receives ASCII code 65, it recognizes it as a capital A and fires the pins in the right order to produce a recognizable letter. A printer that permits downloadable characters lets you redefine the font to suit yourself. If you change the instructions for code 65, the printer will thereafter produce your special character every time it receives the code that usually means a capital A.

The disadvantage is that downloads are tied to the usual conventions of printed text, with six lines of text per inch with a narrow space between lines. If you need larger characters or figures formed from conjoined characters, you'll be frustrated by the gaps. Though you may try to avoid this problem by changing line spacing, you may at the same time

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SCIENCE

produce crowded text.

Dot matrix printers are rapidly approaching the print quality once reserved for daisywheel and thimble printers. However, when you want true letter quality, daisywheel and thimble printers are still unequaled. The lack of graphics machines poses yet another problem for the technical word processing system, but the use of several print elements for a single document is one solution. By using a daisywheel with an extended character set, the Diablo 630 minimizes the need to switch elements.

Help is Here

These solutions are useful but not completely satisfactory. Now, however, more help is available. Triad Computing has released *T³*, a word processing program designed for technical writing. Now writers with specialized needs can define their own customized fonts, using as many as eight different 128-character fonts in a single document. In addition to those you design yourself, *T³* offers fonts for the entire IBM character set, plus italics, script, Cyrillic letters, and chemical and scientific symbols.

T³ cleverly avoids the clumsy use of overstruck characters to substitute for unavailable symbols. It translates each character in the text file into a three-part instruction to the printer.

Each part consists of four numbers. The first two define horizontal and vertical offsets from the lower-left-hand corner of the normal character position; the last two specify the daisywheel and the position of the desired character on the wheel. The document is run through the printer's tractor feed once for each different daisywheel. This way, three symbols from as many different daisywheels may reside in the same character space. However, by suitably defining the character offsets, you can build up large symbols such as three-part integral signs. *T³* supports the Diablo 630 extended character set because it can precisely position the printhead.

T³ presently operates under the UCSD p-system, so its most notable characteristic is its slowness. A decent typist entering straight text can easily outrun the keyboard buffer. However, as the densi-

Writers can define
their own
customized fonts,
using as many as
eight different 128-
character fonts.

ty of technical matter increases, *T³* quickly overtakes the Selectric juggling act.

Triad is developing a faster DOS version that will be a relief to those of us who prefer to think of drives A: and B: rather than volumes 4 and 5. (You don't need a copy of the UCSD p-system to run *T³*; the program comes with runtime support.) Until the DOS version is out, you wouldn't want to use *T³* for ordinary word processing.

T³ demands a powerful PC. You need either a PC-XT with 256K RAM or a regular PC with 512K. I have run *T³* on an ordinary PC with 256K RAM, but the number of disk accesses for overlays retards the system severely.

T³ is a "what you see is what you get" word processor. You must have a color/graphics board in your computer, because the different fonts are generated on your screen in graphics mode. The screen displays subscripts and superscripts in their proper positions, and you can use up to 25 levels of subs and supers. Editing does not disrupt them; they move as if attached to their base symbols. *T³* adjusts line spacing automatically when you insert subs and supers. *T³* Version 1.01, released in May for \$495, is still a work in progress, but purchasers of the system are temporarily being granted 180 days of free phone support instead of the usual 90. The next

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SCIENCE

update, which will be sent free to current users, will offer some additional features, most significantly a search and replace function. The preliminary documentation, a three-ring binder containing a photo-reproduced typescript, apparently generated on *T³* itself, is interspersed with screen dumps for illustrations. The updated *T³* release will come with a typeset manual in the approved, slipcased IBM format.

In addition to a "tyro" tutorial, the manual contains a reference section on the features of *T³* and p-system utilities (for formatting disks and making backups). An index is planned but does not exist in the current manual. For the most part the detailed manual is helpful.

Triad has optimized *T³*. You can enter the multiple-keystroke characters required in mathematics, such as tall brackets or integral signs, via macros you define. You can completely redefine

Triad's *T³* is getting a workout, while my Selectric sits quietly under its dust cover.

the keyboard. A Dvorak keyboard setup is optional.

The printer drivers for *T³* use the graphics capabilities of dot matrix printers to produce the special fonts. The current release supports the IBM Graphics printer or an Epson printer with Graf-Trax. Separate drivers are available at an extra cost of \$45 each for the Okidata 2410, Toshiba P1350 and P1351, and the Santec S700. *T³* will also support letter quality printers such as the Diablo 630 extended character set, but you will not be able to take full advantage of *T³*'s font-editing features. As a part-time endeavor, I write student supplements for college math textbooks. Triad's *T³* is getting a workout as I prepare to generate the

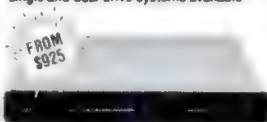
camera-ready copy. My Selectric sits quietly under its dust cover. ■

Anthony Barcellos is a government ana-

lyst in Sacramento, California, a freelance mathematics editor/writer, and software librarian of the Sacramento PC User's Group.

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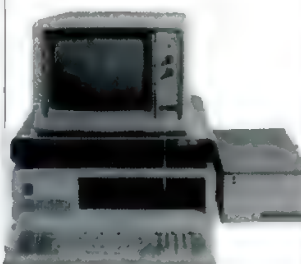
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Perfecting Legal Letters: Clean, Clear Copy

Paperwork is any lawyer's middle name. With that indisputable fact in mind, law firms—large, small, and in between—are finding that an efficient office must automate its printing.

Lawyers, notoriously meticulous about the appearance of their printed work, are among the heaviest users of word processing. If their clients can't understand the impenetrable jargon, the document should, at least, look good. So goes the conventional wisdom.

From the largest corporate firms to the smallest solo practices, choosing the right printer is a crucial decision. No matter what other benefits word processing may bestow, print quality as clean and clear as the output of the classic IBM Selectric is the lawyer's first criterion.

High-End Printing

At large firms, the usage is heavy, the equipment is expensive, and the selection process is ongoing. In the main office of one major Manhattan-based law firm, two IBM 6670 laser printers costing \$50,000 each churn out 600 letter quality pages every hour. This is only a third of the 30-page-a-minute rated speed of the printer, but it seems to be the inevitable difference between the maximum capacity the printer's manufacturer touts and the cruising speed attained in normal usage.

The firm does not take advantage of the laser printer's capacity to reproduce many different print fonts. It uses a standard typeface to achieve a consistent



look and to keep pages interchangeable, regardless of how many lawyers and secretaries work on a project. If graphics are needed, the documents are shunted off to be printed in a separate word processing department.

To cut the turnaround time, each secretary has a word processing terminal at his or her desk. Every three secretaries share an IBM impact printer located near their work stations and neatly ensconced in an acoustical cover. The secretaries themselves print out any document under ten pages. They send any document that runs ten pages or more to the in-house word processing department.

At Zimet, Haines, Moss & Friedman,

a smaller law firm in midtown Manhattan, the staff has used word processing for 6 or 7 years with considerable success. Six terminals, scattered throughout the firm, are accessible to the 10 secretaries who work for the firm's 22 lawyers. Occasionally, and particularly for revisions, the lawyers themselves use the terminals. These terminals are connected to three printers: one dot matrix for interoffice work and drafts and two letter quality impact printers for everything else. In spite of these changes, the secretaries still keep typewriters at their desks to type forms and envelopes and to handle very short items.

The Lone Lawyer

The adventurous attorney who sets up a private practice, leaving the support services of a large law firm, can put together a system that will perform the necessary functions at an affordable price. Solo practitioner Bruce Johnson is a case in point. When he began his own practice in early 1983, his first investment was an IBM PC with a Brother HR 1 daisywheel printer. The HR 1 model has been discontinued, and the next model has been discounted to half the \$800 he invested. Still, Johnson likes the excellent print quality his Brother produces, and he's had no problems during the year or so he's used the printer. The Brother HR 1

churns out letters, court papers, envelopes, and labels at the rate of 200 words per minute, an adequate speed for Johnson's current needs.

Joan Yates left a large firm—of 150 lawyers—but, unlike Johnson, Yates formed a partnership. At Reaves & Yates, she practices commercial law and

litigation. Relatively speaking, her needs are small: just one word processor. Yates has found her firm's small size to be a disadvantage at times. For example, representatives of large companies didn't want to make house calls or give demonstrations, and all she could get from them were a few brochures in the mail. The suppliers of the IBM Displaywriter did give her a demonstration, but the machine was too expensive, she thought. Besides, Yates was disconcerted to discover that a particular word processing system cost \$15,000 at one viewing, \$11,000 a few months later, and \$8,000 not long after that.

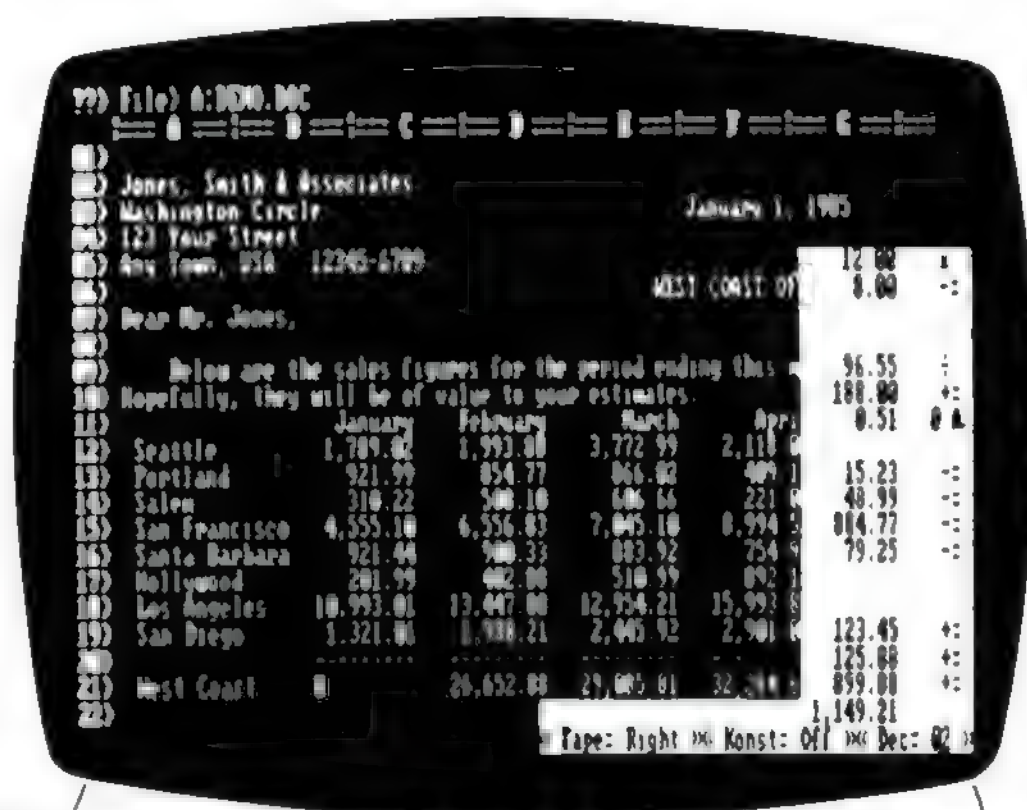
Yates eventually chose a Syntrex system that has its keyboard right on the Aries printer. When her firm needs to type on preprinted forms (a difficult function with most word processors), the word processing feature can be turned off so that the Aries functions as an old-fashioned typewriter. Retrogression has its charms.

Once she had the Syntrex in place for essentials, Yates began to educate herself by reading computer magazines and realized that the IBM PC was a machine to be reckoned with. Although she bought her IBM PC for home use less than a year ago, she quickly moved it to the office. Next she got a letter quality daisywheel printer that prints 15 to 18 characters per second. Yates and her partner occasionally use it themselves for confidential work.

Only the Best

Almost a year ago, W. James MacNaughton paid out \$1,600 for a letter quality Qume to attach to his IBM PC. This purchase, he explained, was in line with his philosophy of buying the best equipment for his law practice. He is happy with the Qume's output, but he sees two problems with it. First, he thinks the accessories are inadequate. In less than a year, he is on his third daisy wheel. MacNaughton doesn't think the usage justifies the number of chips and

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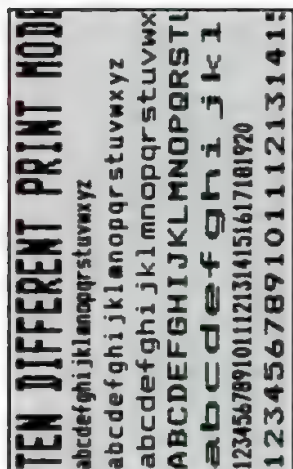
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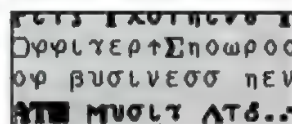
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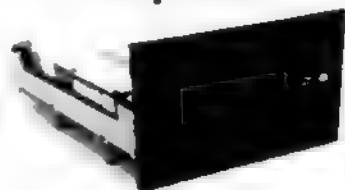
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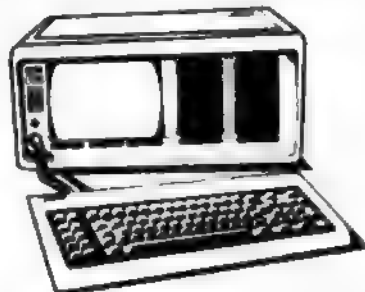
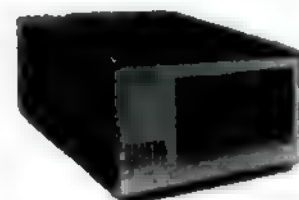
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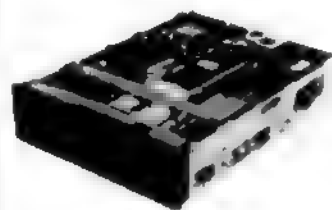
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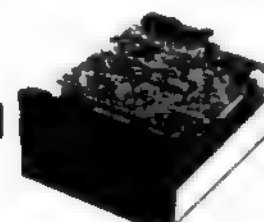
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breakage the individual letters have shown on the copy. Second, when setting up the printer, MacNaughton found information in the service manual so useless that he first called his dealer for the manufacturer's 800 number and eventually wound up reading the manual to the technician for clarification.

If he were buying a printer today, MacNaughton says, he would buy an NEC 3550 Spinwriter, which he considers the top of the line.

When Charles T. Locke left an insurance company to establish his own law practice, he bought, for his PC-XT, both an Epson FX 100 dot matrix printer and a NEC 3550 Spinwriter with a single-sheet feeder. If the incremental cost had not been so high, he says, he would have purchased a dual sheet feeder, one for his letterhead and one for the plain continuation sheets. The dot matrix printer not only does graphics, but it's also fast and economical for preliminary drafts of documents.

Ribbons for the NEC 3550 cost between \$12 and \$15 and produce from 60 to 70 pages of excellent print quality at a cost from 17 to 25 cents per page. Locke saves money by using the dot matrix printer for drafts of 30- to 50-page contracts and the NEC just for final versions.

Locke got advice on word processing set-ups from a colleague, Joseph A. Maria, who had equipped his own law office in White Plains, New York. Maria has two XT's and one PC hooked up to three printers. Two of the printers, an IBM 80 and an Epson 100, are fast draft-quality machines that use inexpensive ribbons and paper.

For documents that leave the office, Maria uses the letter quality NEC 3550 and its dual sheet feeders through a shared A-B switch. Both his XT's are plugged into the printer and feeders. All the equipment performs adequately, but, should the NEC begin to need substantial repairs, Maria may upgrade the heavily used printer to a small laser printer.

Perhaps because their limited budgets

force them to be resourceful, lawyers who work alone or in very small firms seem to do the most experimenting with printers and take the most risks. At firms

large and small, however, lawyers agree that it is difficult to run an efficient office without automating the production of the printed page. ■

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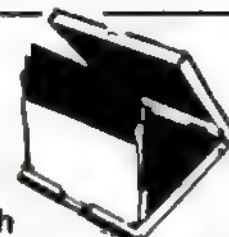


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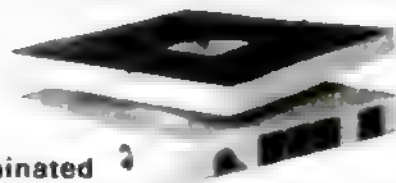
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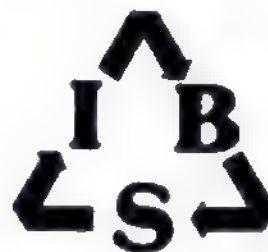
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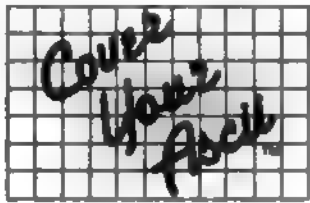


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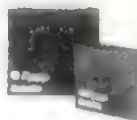


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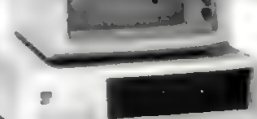
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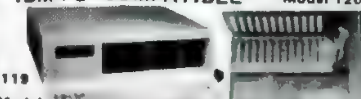
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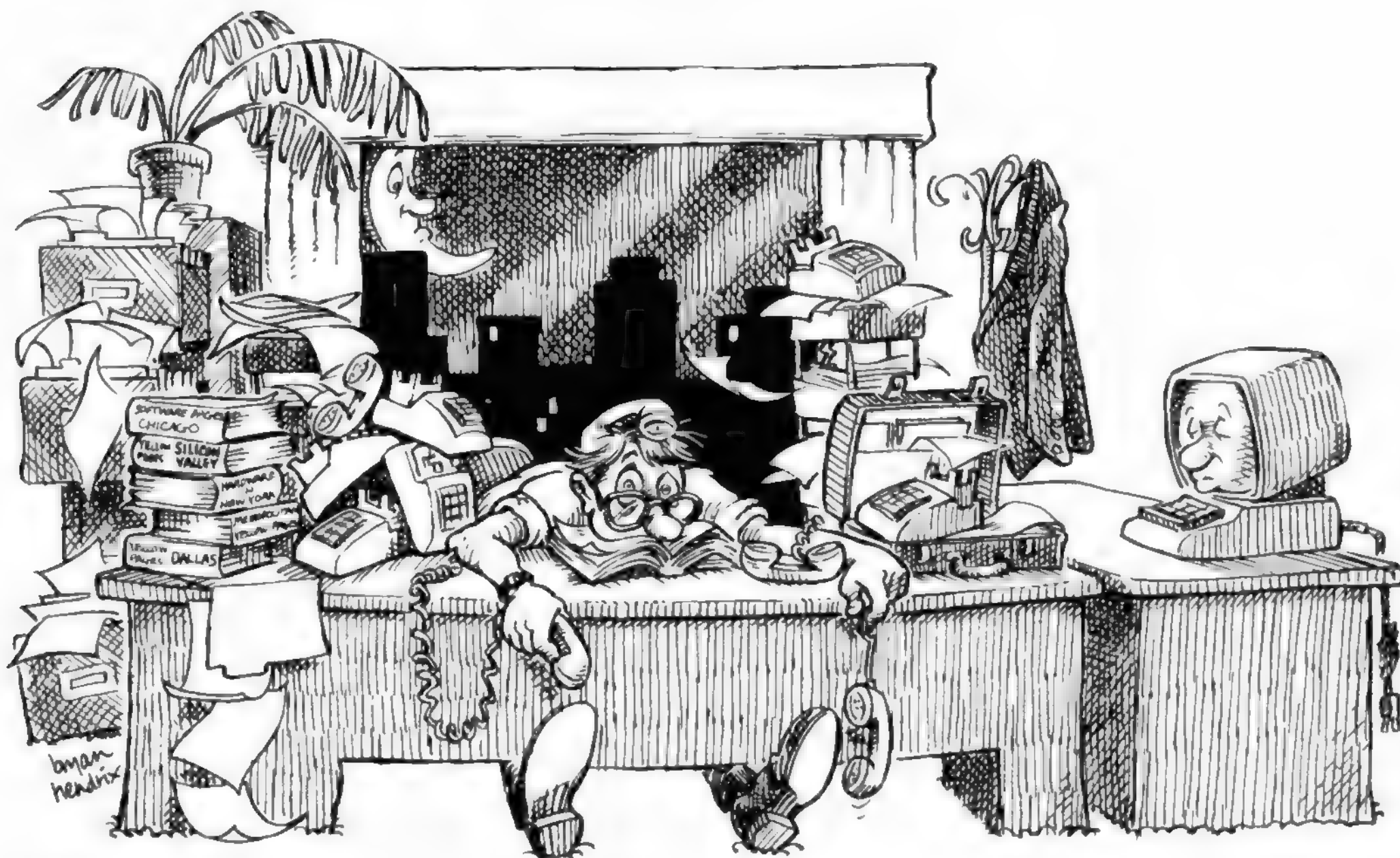
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User-to-User

PC readers use this forum to help one another by passing along their questions, solutions, comments, and complaints.

The tips and tricks in the following letters were tested by David Hoffman, president of Abacus Productions, a New York-based consulting firm. The comments that follow each letter are his.



An Alternate Approach

Most people who have NEC Spinwriter 3550 printers—the letter quality printer designed specifically for the IBM PC—do not use their printers to full advantage because they do not understand how to access the alternate character set on the Spinwriter thimbles. The alternate character set is the set of between 26 and 33 extra characters—not accessible by pressing a standard keyboard key—that exist on about half of all NEC thimbles.

For example, the Super Courier thimble comes with a character set that

includes fractions, trademark and copyright symbols, and very small numerals that print in the upper half of a line and can be used instead of superscripts with single-spaced text. Light Italic/Manifold includes the italic typeface as the standard character set and the upper case of the Manifold typeface as the alternate character set. Scientific/Times Roman includes many scientific and mathematical symbols in the alternate character set. Other thimbles include still different alternate character sets, including foreign-language symbols. The question is how to make the printer print these alternate characters.

With the original version of the NEC 3550, the STX command directed the printer to the alternate character set. You then sent keyboard equivalents of the alternate characters that you wanted to access. For example, the keys QWERTYUIOP were the equivalents for the small numbers one through nine and zero on the Super Courier thimble. After typing the appropriate keyboard equivalents for the alternate characters desired, you then returned to the standard character set with the ETX printer command. As long as you used a word processor that could send direct printer commands, this was extremely simple. If you have an early revision NEC 3550 that has never had its PROM chips changed, this may still be the correct procedure for you. However, this

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USER-TO-USER

procedure was discontinued on later versions of the NEC 3550. (If you are using Version 3.2 of *WordStar* or a later version, or if your printer manual does not include the ETX and STX controls in the Control Codes Table, you have a later version of the printer).

Figure 1 shows the listing for an easy-to-use BASIC program to produce a chart displaying the ASCII value associated with each of the alternate characters on the thimble installed in the printer when the program is run. Before running the program, note the name of the thimble you will be using. (The name appears on the NEC box and is engraved on the inside bottom of the thimble.) The program begins by asking you to enter the name of the thimble. It then prints the name at the top of the chart. By repeating the procedure for each thimble you have, you will develop a reference chart for the alternate character set on each thimble.

If the program runs but lists no characters next to any ASCII values, then that thimble has no alternate character set. If alternate characters appear next to most of the values but blank spaces or ink smudges appear next to others, the values with no characters are not used on that particular thimble. (Not all the alternate character sets contain the same number of characters.)

The program listing includes only ASCII values 193 through 255. If you are using a standard English-language thimble, the table produced by the program can be truncated by substituting the number 224 for 255. However, some thimbles may use the values between 225 and 250 for special characters.

On almost all of the thimbles I have tested, only the values 193 through 224 produce characters not accessible through the keyboard. Values below 193 almost always refer to the standard character set and various printer and communication control codes that are not relevant here. In addition, some of the lower values will spoil the chart by issuing printer commands such as line and form feeds. On the Super Courier thimble, value 192 causes all subsequent numbers to be printed incorrectly. Therefore it is recommended that for information about the alternate character set, you use 193 as the lower value and either 224 or 255 as the upper value. The only exception to this I have found so far is that the Prestige Reknown 15/12 thimble uses value 192 for the copy-right symbol. If you have an unusual thimble and you believe you are not accessing all the characters in the alternate character set (for example, if the thimble brochure shows nonstandard characters not displayed in the program chart or accessible

```

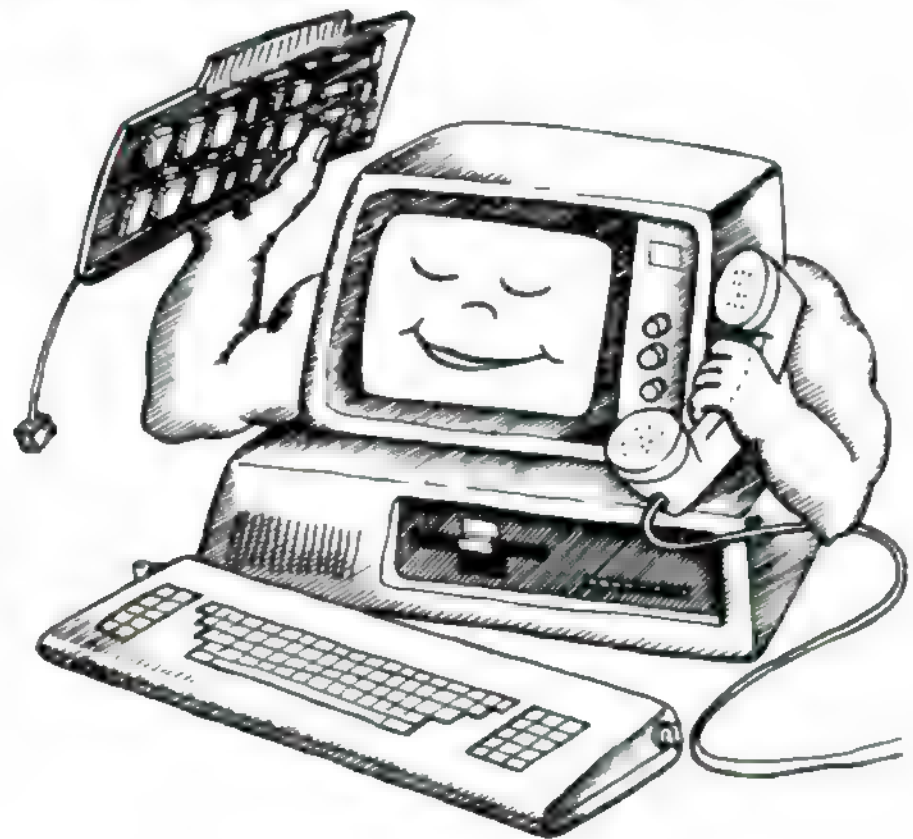
100 REM PROGRAM THIMBLE
110 REM
120 REM This program will print the ASCII value needed to access
130 REM each of the characters in the "alternate character set"
140 REM of NEC Spinwriter printing thimbles. Once you know the
150 REM ASCII value, it can be sent to the printer using whatever
160 REM procedures your word processor has to do this.
170 REM Before printing the ASCII values and characters,
180 REM the program will ask you for the name of the thimble, which
190 REM will be printed at the beginning of the listing.
200 CLS
210 INPUT "Name of Thimble";B$
220 LPRINT B$
230 LPRINT CHR$(10)
240 FOR A=193 TO 255
250 LPRINT A;" ";CHR$(A);CHR$(32);
260 NEXT
270 LPRINT CHR$(13)
280 LPRINT CHR$(10)
290 END

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Figure 1: This program produces a chart that displays the ASCII values required to produce spinwriter alternate characters.

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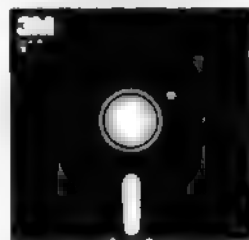
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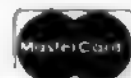
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CIRCLE 179 ON READER SERVICE CARD

USER-TO-USER

from the keyboard), you can change the program to use a value lower than 193.

Once you know the ASCII value for the character you want to print, you can use it in programming with the normal statements for printer commands—for example, in BASIC with CHR\$(). In a word processor, you must use that word processor's procedures for sending ASCII values to the printer. For example, *EasyWriter 1.15* uses .USER commands to send ASCII values. The .USER commands involve assigning a standard keyboard key as a substitute for an ASCII value. If you were using the Super Courier thimble with *EasyWriter* and wanted to print a copyright symbol, you would send the ASCII value 206. You would first decide on a

standard keyboard equivalent, such as the less-than sign (<). You would enter the .USER<206 command in *EasyWriter*. From that point on, whenever *EasyWriter* encountered the less-than sign in your text, it would send the ASCII value 206 to the printer and the printer would print the copyright sign. In *Volkswriter Deluxe*, on the other hand, the procedure is to hold down the Alt key and then type the desired ASCII value from the numeric keypad. *WordStar 3.3* requires you to choose the desired alternative characters in advance and, using the installation procedure, assign ASCII values to the user-definable commands ^PQ, ^PW, ^PE, or ^PR. Each word processor accesses nonkeyboard characters in a different way (and some,

unfortunately, lack an access procedure).

Ada Finifter
East Lansing, Michigan

A quick check of thimbles around the house revealed bonus characters on APL-10 (Prestige Elite) and Courier-72/Manifold. Courier Legal 10B, Courier 10, and Courier-72 contain mostly blanks and repeats above ASCII 192.

A Peach of a Fix

Peachtree Software never configured its *PeachText 5000* word processor to take advantage of the IBM/Epson dot matrix printers. After a little digging into the Peach literature and a few phone conversations with the company's programming staff, I discovered a way to use the capabilities of my Epson printer to produce report-quality print formatting.

The *PeachText 5000* word processing package does not support the Epson MX-80 or FX-80 printers except in the draft mode. This means that only limited formatting commands are available from the word processor, although these printers are capable of much more. To circumvent *PeachText*'s shortcomings, a series of commands can be imbedded in the text to output control commands at the necessary times. These commands are special unprintable ASCII characters sent by the word processor using the OUT command. The PC's manual lists the special control codes for MX printers, while Epson furnishes a complete list with its FX models. Figure 2 contains a sampling of these commands and how to use them.

Michael Roginsky
Powder Springs, Georgia

Note that this method will not work in edit mode. You must choose Print Document from the menu, or the commands will have no effect.

PeachText users with other printers not blessed by Peachtree should also pay attention. The numbers following /out in these examples may be different, but the

Double width until line feed:	\out14		
Double width:	\out27,87,1	off: \out27,87,0	or: \out20
Compressed print on:	\out15	off: \out18	
Underline on:	\out27,45,1	off: \out27,45,0	
Emphasized on:	\out27,69	off: \out27,70	
Subscript:	\out27,83,1	off: \out27,84	
Superscript:	\out27,83,0	off: \out27,84	
Double strike:	\out27,71	off: \out27,72	

Figure 2: Sample Peachtext control codes that handle special formatting commands on Epson FX-80 and MX-80 printers.

```
A>copy graphics.com grafstar.com
```

```
1 File(s) copied
```

```
A>debug grafstar.com
```

```
-e 0169
```

```
xxxx:0169 18.10
```

```
-w
```

```
Writing 0315 bytes
```

```
-g
```

```
A>
```

Figure 3: This program corrects screen dump distortion on Star Micronics Gemini 10X printers. (Note: You enter only the underlined portions.)

USER-TO-USER

```
150 '  
160 'THIS PROGRAM DEMONSTRATES THE INABILITY OF IBM PC DOS 2.0 DISK BASIC  
170 'TO SEND CHR$(26) TO THE PRINTER PORT.  
180 '  
230 '  
240 FOR I= 21 TO 31  
250 LPRINT CHR$(27);"D";CHR$(I);CHR$(0);: 'Set TAB to col. I (Epson/IBM)  
260 LPRINT CHR$(9);"THIS LINE IS INDENTED TO COLUMN";I  
270 NEXT
```

```
THIS LINE IS INDENTED TO COLUMN 21  
THIS LINE IS INDENTED TO COLUMN 22  
THIS LINE IS INDENTED TO COLUMN 23  
THIS LINE IS INDENTED TO COLUMN 24  
THIS LINE IS INDENTED TO COLUMN 25  
THIS LINE IS INDENTED TO COLUMN 26  
THIS LINE IS INDENTED TO COLUMN 27  
THIS LINE IS INDENTED TO COLUMN 28  
THIS LINE IS INDENTED TO COLUMN 29  
THIS LINE IS INDENTED TO COLUMN 30  
THIS LINE IS INDENTED TO COLUMN 31
```

Figure 4: This short program and printout demonstrate the FX-80's inability to set a tab at indent 26.

```
150 '  
160 'THIS PROGRAM DEMONSTRATES A METHOD FOR CIRCUMVENTING THE INABILITY OF IBM  
170 'BASIC (RELEASE 2.0) TO SEND ASCII CHARACTER 26 TO THE PRINTER PORT.  
180 '  
190 'MACHINE LANGUAGE ROUTINE USR(I) SENDS ASCII CHARACTER CHR$(I) TO  
200 'THE PRINTER PORT  
210 '  
240 '  
250 DEFINT I-N  
260 DEF SEG=&H1700  
270 DEF USR=0  
280 RESTORE 410  
290 FOR I=0 TO 7  
300 READ J  
310 POKE I,J  
320 NEXT  
330 FOR J=1 TO 4  
340 READ I  
350 V=USR(I)  
360 NEXT  
370 FOR I=0 TO 255  
380 V=USR(I)  
390 NEXT  
400 END  
410 DATA &H3E,&H8A,&H17,&HB4,&H05,&HCD,&H21,&HCB  
420 DATA 27,75,0,1
```

(continued)

Figure 5: The USR function in this program calls an assembly language module that lets BASIC send an ASCII 26 to a printer.



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3E	DS:		;Set segment to value in register DS.
8A17	MOV	DL,[BX]	;MOVE low order byte of function ;argument into DL.
B405	MOV	AH,05	;Place the number of the DOS function ;call for printing a character into AH.
CD21	INT	21	;Issue system interrupt 21 (invokes the ;DOS function whose number is in AH.
CB	RETF		;Executes a FAR return (to BASIC).

Figure 6: Actual assembly language module called by USR function in BASIC program to send ASCII character 26 to a printer.

technique could unleash special powers in both dot matrix and daisywheel printers. Check your machine's documentation for help with these control or escape codes.

Cleaning Up the Dump

Although I'm generally pleased with my Star Micronics Gemini 10X dot matrix printer, I was concerned that I could not easily transfer screen images from my PC to the printer. The GRAPHICS.COM program in DOS 2.0, which normally allows Shift-PrtSc to perform a screen dump of text and graphics, is set up for the Epson/IBM printer. Since the Epson uses a slightly different code to initialize line spacing, printing screens on my Gemini 10X produces distorted images caused by excess blank space between the printed lines. Luckily, this is easy to correct.

First, start your system with a copy of your DOS 2.0 disk in the A: drive. Then enter the listing in Figure 3 after either the DOS prompt (A>) or the DEBUG prompt (-).

Then by entering GRAFSTAR at the DOS prompt, you'll be able to use Shift-PrtSc for screen dumps, including graphic characters, lines, circles, and so on. For convenience, put the GRAFSTAR statement in your AUTOEXEC.BAT file.

The original GRAPHICS.COM program initially sends three characters to the printer: 1B, 33, 18. These are the hexa-

decimal equivalents of the ASCII characters for escape, the digit 3, and the value 24, which an IBM/Epson printer interprets as instructions to set the line spacing to 24/216ths of an inch. A Star Micronics printer, however, uses this instruction to set its line spacing to 24/144ths of an inch. So, to set things right, use DEBUG's EDIT command to change hexadecimal 18 to hexadecimal 10. Doing this to a copy of GRAPHICS.COM named GRAFSTAR.COM (be sure to save a copy of the original) will set the line spacing to 16/144ths of an inch on the Star printer.

This same logic can be used to patch GRAPHICS.COM for other popular dot matrix printers. The addresses of the three bytes mentioned above are xxxx:015D, xxxx:0163, and xxxx:0169.

James A. Thomson
Denver, Colorado

This 5-minute procedure will be welcomed by graphics fans who use either the Gemini 10 or 15. Remember to have the DEBUG.COM program on your DOS disk handy. Correcting this problem on other printers requires consulting their manuals to determine an appropriate escape code sequence, if one exists.

ASCII 26 Problem

IBM BASIC (Release 2.0) contains an error that prevents ASCII character

CHR\$(26) from being sent to the printer port. As a result, all attempts to send the character are simply ignored by the BASIC interpreter.

While this is not generally a problem since CHR\$(26) is ignored by most printers, it can play havoc with programs that use advanced features of IBM printers and the Epson FX-80. These printers use ASCII characters to receive numerical information. For example, to set a tab at column 26, one sends a tab set code followed by ASCII character CHR\$(26). In graphics mode, all ASCII characters correspond to particular patterns of dots. Needless to say, a graph will become hopelessly garbled if all occurrences of a particular pattern are trapped before reaching the printer port. There are always ways to circumvent the problem in individual instances, but it is unreasonable to test each character in a large graphics program to determine whether special treatment is required.

The listing and printout in Figure 4 demonstrate the problem using the Epson FX-80 commands for setting horizontal tabs.

The programs in Figure 5 demonstrate a simple (if not completely satisfactory) method to circumvent the problem. The machine-language subroutine in Figure 6 uses system interrupt hex 21 to invoke the DOS function for printing a character. All

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USER-TO-USER

printer output that could possibly involve CHR\$(26) can then be handled by invoking the BASIC function V=USR(I) to send CHR\$(I).

David P. Kierstead
Honolulu, Hawaii

This solution pokes a short machine-language subroutine into memory and invokes it by using the DEF USR and USR functions. BASIC's printing routine is bypassed entirely and all information is sent to the printer by way of DOS. It is not necessary to go into graphics mode (delete lines 320-350 and line 410) although you have to modify line 360 to avoid sending nonprinting ASCII characters such as form feeds and beeps.

Keeping Tabs

Many people know that the DOS command TYPE, along with the Ctrl-PrtSc key combination, can be used to send information to the printer. This might prove useful when you have a text file that contains horizontal tab characters that are used in formatting the document but you do not have tab positions set on the printer. The COPY command doesn't expand tabs, so COPY FILENAME.EXT PRN will not give satisfactory results in this case.

Tab expansion can cause problems if you are sending graphics information to a dot matrix printer. The expansion of one byte of CHR\$(9) into eight bytes of CHR\$(32) will confuse the printer and turn your graphics printing into an unrecognizable mess. There are at least two fairly obvious solutions to the problem. You can either use COPY FILENAME.EXT PRN to send the graphics file to the printer or make sure that none of the graphics data is the equivalent of the tab character, CHR\$(9).

The PRINT command (in DOS 2.x) can be used to send information to the printer as a background task, leaving you free to use the computer for other things. But the PRINT command expands the tab character just like the TYPE command

does. So, if you use the PRINT command to send graphics information (as for a logo on your letterhead), watch out for the CHR\$(9).

Here is some practical information for users of Prowriter I and II printers. If you hold down both the SEL and the LF buttons and then turn on the printer, all the information that is sent to the printer will be printed in hexadecimal notation. This procedure can be very useful for debugging a program that sends information other than text to the printer (especially on the assembly language level). I suspect that the same thing can be done with an NEC 8023A printer because of its similarities with the Prowriters, although I have not personally tested it.

Michael L. Hoyt
Solsberry, Indiana

Thanks for pointing out an important difference in these seemingly equivalent DOS functions, though most users need not be alarmed. It is fairly uncommon (though a good exercise) to send pure ASCII files containing graphic printer information directly from DOS. More often, the codes are sent through a high-level language or a commercial program.

Some printers have default tab settings built into them, so the difference between the two techniques using text files may not be initially apparent. You may be able to set your printer's internal tabs to take advantage of the ASCII 9 tab character that DOS sends it.

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PC Tutor

A Printer in Every Port

Q: I have an IBM PC-XT with 256K, a color/graphics adapter, a color monitor, and a printer attached to the parallel port. I'd like to connect an additional printer (a



Smith Corona TP-1) to the XT's serial port.

I don't know which DIP switches need to be reset in the new printer to make it compatible with my computer. Smith Corona provided me with a table and this comment: "Some DIP switches may require resetting to conform with the host computer." The table wasn't specific enough; so far I've left the switches the way they were set at the factory.

As I recall from the DOS manual, I'll need a device driver to operate the printer, but I'm not sure how to obtain or install such a program. What do I need to do?

Horner F. Baird
Lancaster, California

A: First, make sure your cable works correctly, since nothing else will work if the physical connection is unsuitable to begin with.

The Smith Corona TP-1 contains a set of seven switches. According to your table, the first switch determines the number of data bits for each character (7 or 8); the second and third determine whether

odd, even, or no parity is used; the last four switches indicate a baud rate in a range from 50 to 19200.

IBM's serial port is capable of handling any of these possibilities, so your choice of switch settings should be based on functionality.

You probably should use the 8-bit character length with no parity, although neither of these play much of a role in a computer's relations with a printer. Some programs, however, may set the eighth bit unintentionally; if that's the case with your software, try setting the switches for 7-bit characters and even parity.

What baud rate should you use? The higher you set the rate, the faster the computer and printer will communicate. Transmission errors, however, are more likely to occur at higher speeds. Your computer's upper limit is 9600 baud. You're unlikely to notice any difference in the printer's operating speeds with the available rates 2400 baud or higher, so I'd suggest sticking to 2400 baud for the greatest reliability.

If the TP-1 has no provision for handshaking signals (which tell the PC when the printer buffer is full) or if your PC's text editor doesn't support handshaking, you must keep the baud rate below the printer's typing speed. Theoretically, 30 baud would be too fast for a 30 character-per-second printer, but in practice this speed usually works fine.

You don't need a special device-driver program. You can use the MODE command by entering lines such as these:

```
A> MODE COM1:2400,N,8
A> MODE LPT1:=COM1
```

The first line specifies that the serial port has a 2400 baud rate, no parity, and an 8-bit character length. The second line directs the computer's printer output to the serial port.

(continued)

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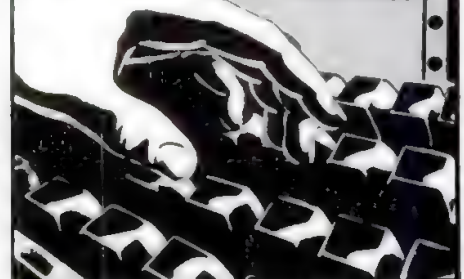
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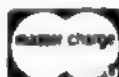
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PC TUTOR

Poisonous Printer Port

Q: After I saw a test routine for printers in User-to-User (see "Printer Test Redux," PC, Volume 3 Number 9, page 426), I tried running it. This was the BASIC routine:

```
10 FOR I=0 TO 1024:
  IF INP(1)=223 THEN PRINT I
20 NEXT I
```

When my computer reached I=64, it hung up and I had to turn it off and on again. Can you tell me why?

Another thing puzzles me about this routine. On my system, port 957 returns the value 220—not 223—when the printer is on line and ready. Why is there this difference?

Charlie Trotter
Monmouth, Oregon

A: When you ran that test routine, your computer died at the point the program tried to read port 64, which caused the memory refresh to fail.

That port location is tied to the Programmable Interval Timer, an Intel 8253 chip with three independent counters. This is what Intel's manual says about that chip: "Due to the internal logic of the 8253, it is absolutely necessary to complete the entire reading procedure. If two bytes are programmed to be read, then two bytes must be read before any loading WR command can be sent to the same counter."

When you read only one byte from the counter, you probably caused a subsequent timer operation to fail. This may have caused timer line 0, which controls memory refresh, to stop running. Timer line 0 should run continuously so it can periodically stop the computer to generate a refresh. Without a frequent refresh, your computer would lose the contents of its memory.

According to IBM's Technical Reference manual, the printer port's bottom three status bits are unused. A quick look at the schematic diagram of the printer card confirms that those bottom three bits

are not output. Therefore, any value at the printer port from 216 to 223 (in hexadecimal values, that's from &hD8 to &hDF) means the printer is on line and ready.

Printer out of Faze

Q: We run BPI's General Accounting software on our IBM PC. In the hope of increasing speed we bought a 64K Microfazer (made by Quadram Corp.), but the results were zero. We thought this device was defective and returned it, but the replacement also did not work.

We called Quadram and were told the Microfazer should work with our software. Since then, someone else suggested that the problem was due to the way the accounting program was written. Can you figure out which part is to blame?

H. Ed Hanna
Tulsa, Oklahoma

A: This problem could have any number of causes. The most likely cause of printer problems is the cabling. I recommend you be very conservative and always buy the highest-quality cables you can find. Although some cables will work with most programs, you shouldn't have your choice of software be limited by the cables.

Usually, printer problems are influenced by the way a program detects errors. A program's detection method might be very strict and require that the printer handshake correctly and at the right time. Another program may be so lenient that it doesn't worry about the printer: This software's attitude is, "Hey! Why worry about the printer? It knows what's right."

If your cable is slightly incorrect, but your BPI software is particularly strict, the program isn't going to trust the printer and the Microfazer buffer enough to let the operating speed be any faster than its most conservative rate.

Another less likely possibility is that some switches are set incorrectly on the Microfazer.

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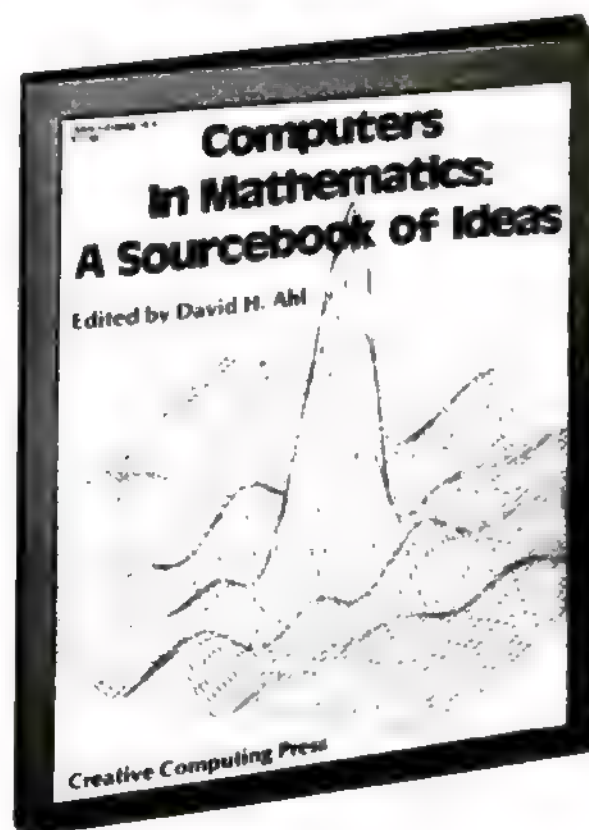
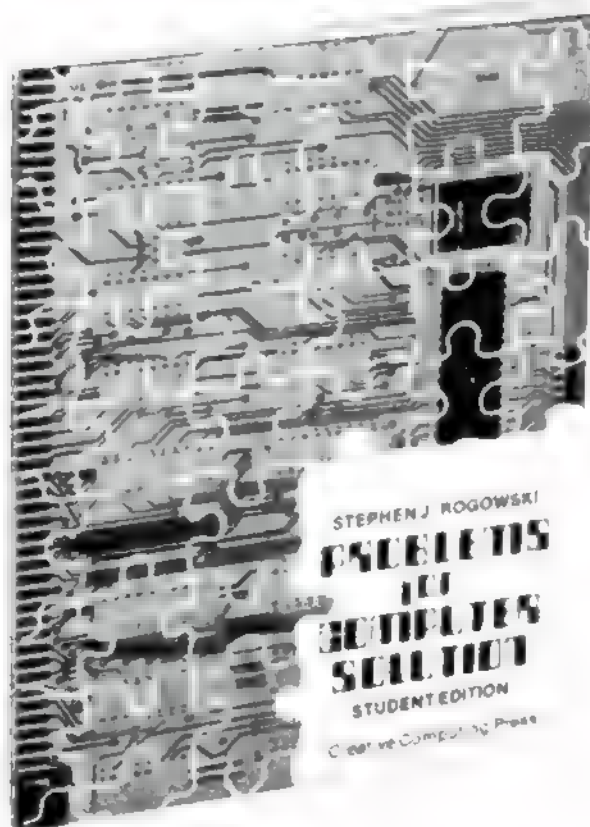
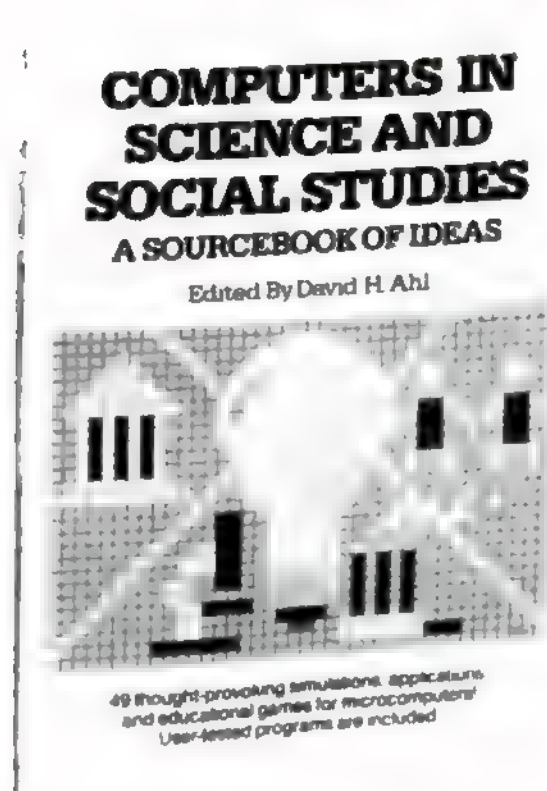
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PC TUTOR

solutions, but I need to know more about the hardware and software you use, the specific symptoms that occurred, and the remedies you've tried. Your letters are the only way I know about your problems: The more details you give me, the more I can do for you.

Your description, "the results were zero," leaves me wanting to ask further questions. Did *PrtScn* operate correctly? When you pressed *Ctrl-PrtScn*, did the printer turn on continuously? In BASIC, could you use *LPRINT* to send output to

The most likely cause of printer problems is the cabling.

the printer? What was the result when you tried copying a file to the *PRN:* device?

Detailed answers to these questions would have helped me solve your main problem. Finding these answers, however, is a good way for you—or anyone—to pinpoint the cause of a problem whenever a printer acts up.

Graphics and Two Monitors?

Q: In a system with 256K that runs PC-DOS 2.0, how much memory is available for the BASIC workspace?

Also, can the IBM PC display text on a monochrome screen at the same time as it displays graphics on the color display? For example, I'd like to have a picture on the graphics display and text or questions about the picture on the monochrome screen. Can a PC do this even though it can't modify both displays at the same time?

Scott Farnham
Pinellas Park, Florida

A: The IBM/Microsoft *BASICA* interpreter takes up about 26K of memory and PC-DOS 2.0 uses about another 30K, so about 200K is left over. *BASICA*, howev-

er, can only use 64K of this, so about 136K will remain out of reach.

One way to reach this excess memory through BASIC is by using the *SHELL* command. Be warned that this command causes problems when used in DOS 2.0.

Some other BASIC interpreters for the PC can use a 1-megabyte data space. I haven't tested any of these yet; I'd suggest investigating their performance and robustness before deciding to switch from the most widely used BASIC.

As to the use of color and monochrome displays together, I recently provided detailed instructions for using both monitors to display text (see "Switch-Hitting Screens" in PC Tutor, PC, Volume 3 Number 12, Page 395). Displaying graphics as well, however, is a problem that's quite a bit tougher.

Try initializing the monochrome display, then initialize the color display. Even though you remain in graphics mode, the monochrome adapter is still initialized, so you can write character data directly into the monochrome memory area.

The monochrome memory is located at segment *&hB000*. The following routine illustrates a technique that you can use to change this display memory directly. Load *BASICA* and have the monochrome display active (*MODE MONO*), then run this:

```
10 DEF SEG=&hB000
20 FOR I = 1 TO 4095 STEP 2
30   POKE I, 33
40 NEXT I
```

This routine changes the attribute of each character location to underlining. Now change line 20 to read *I = 0* instead of *I = 1*; run this routine and see it change the character stored at each location.

The PC Tutor solves practical problems and explains points of general interest. If you'd like to see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016.

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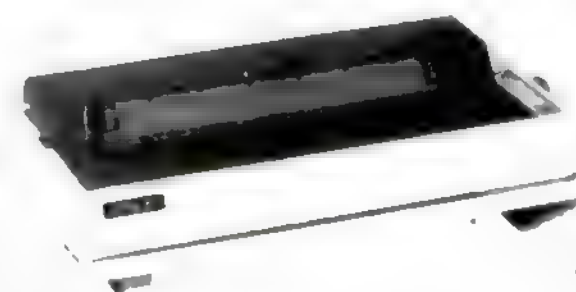
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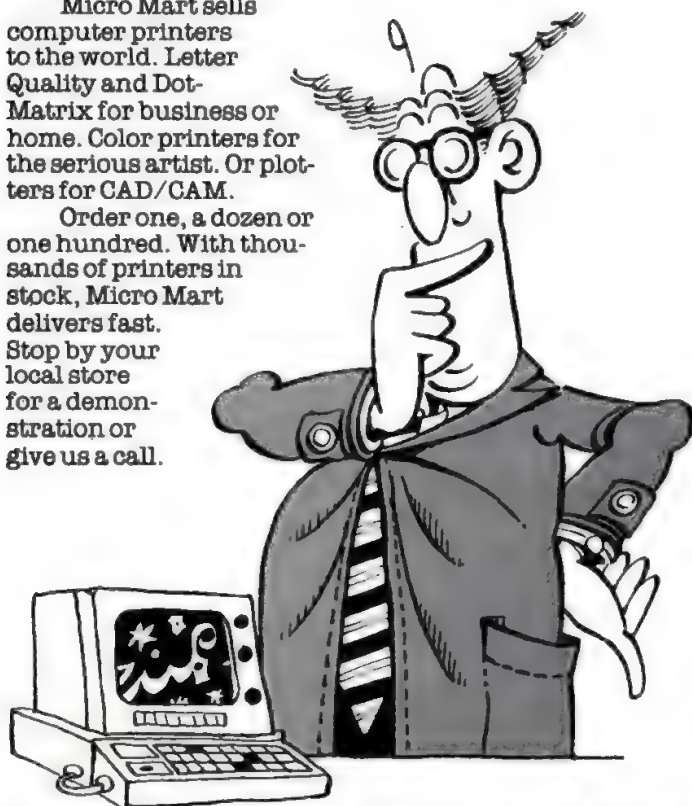
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5,000	3:30	48:07	16:58	*	45:26

*Could not successfully compile the program.

Execution Time Ratio (Gibson Mix; calculated S-Profile)

Realia COBOL	MBP COBOL	Level II COBOL	R-M COBOL	Microsoft COBOL
1.0	3.6	14.7	21.6	22.3

Sieve of Eratosthenes

0.818 seconds per iteration

All benchmark tests were performed on an IBM PC XT with 192KB of memory. IBM PC-XT is a registered trademark of International Business Machines Corporation. MBP COBOL of MBP Software and System Technology. Level II COBOL of Micro Focus. R-M COBOL of Ryan-McFarland and Microsoft COBOL of Microsoft.

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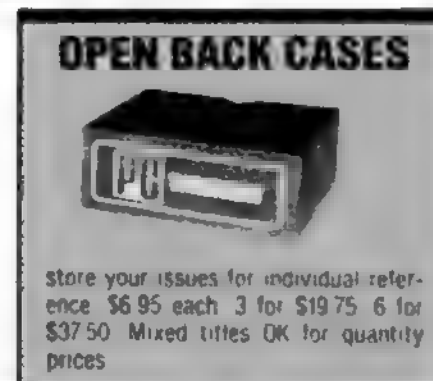


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Four Programs for Printer Interface

Four programs—Printer Basher, Printerface, PrintMan, and PrintStar—let you use your printer's fancy features even as they save you the trouble of learning its control codes.

Today's dot matrix printers offer an almost unlimited combination of print modes, character fonts, and line sizes. Some printers even enable you to create personalized fonts. To take advantage of many of these features, applications programs often will send printer control codes to override the printer's default settings.

How do you take advantage of these features if your software does not support your printer? Until now there was only one way: you had to wade through the programming section of your printer's manual, determine the required control codes, and then write a BASIC program to download your requirements—not necessarily an easy or fun task.

Today, at last, if you want to take advantage of your printer's capabilities, you don't need to write BASIC programs to modify the printer's default settings. *Printer Basher*, *Printerface*, *PrintMan*, or *PrintStar* may be able to do the job for you. These programs send control codes to your printer to let you take advantage of its fancier features.

Printer Basher

Printer Basher by Connecticut Software is a copy-protected program that comes on a single disk with a 25-page instruction manual. Because it is completely menu driven, *Printer Basher* is simple



to use. The initial menu asks you to indicate which one of six Epson or equivalent printers (MX-80, MX-100, FX-80, FX-100, RX-80, or RX-100) you have installed. (Although neither the program nor the documentation tells you so, the program only recognizes the first parallel port on the PC's motherboard.) You move through four additional menu pages, selecting options for character set, character pitch, print mode, line spacing, margins, and form length. The menu reflects your selections, and you can save these settings in one of the ten files for later recall. If you select two incompatible options, *Printer Basher* will revert to the default value.

Printerface

Printerface by Datacon Associates is another menu-driven program. Though similar to *Printer Basher*, it also supports the Toshiba, Prowrite, Tally, Spirit, and Okidata printers. *Printerface*'s mere two pages of documentation only suggest how to use the program and deal with some difficulties you might encounter. The documentation does not even give the address or phone number of Datacon Associates. An on-line Help file only lists the supported printers.

Despite the documentation problem, *Printerface* is a rather simple program to use. Just type the command `PRINTER` and the name of your printer, and the

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WRITING

menu appears on your screen. From this menu you select the font, vertical and horizontal spacing, tab stops, left and right margins, and page length. Another screen then appears on which you enter specific instructions. After you have set any or all desired options, you can sample the effect of these options on your printer. You can then send the control codes either directly to the printer or to a file for later use.

PrintMan

PrintMan by Qualitas has more helpful documentation. Its single disk comes with a 66-page manual, an on-line help function for every screen, and an on-line tutorial. The bad news is that *PrintMan* is so complex that it needs all that documentation. But the good news is that *PrintMan* gives you more control of the printer than any other program reviewed here. You can configure *PrintMan* to operate on any port and with any printer. If Qualitas does not already have a file written for your printer configuration and if you send it a copy of the printer's manual, the company will charge you \$15 to produce the configuration file.

Loading *PrintMan* brings up the first

of 20 different screens and menus, the Profile Selection screen with which you select your printer. In the confusing series of menus that follows, you use the cursor control keys to select the codes you want sent to your printer.

PrintMan also includes a small-scale word processing program, a feature that is useful for setting up simple, repetitive forms although of course it isn't nearly as comprehensive as a complete word processing program.

On the whole, *PrintMan* is a well-conceived and well-executed program with some flaws. It gives you a great deal of help in learning and using its various commands, but it has too many screens and menus for a program of its type. After all, who has the time or the inclination to spend hours working with a utility that only enables you to send control codes to your printer?

PrintStar

PrintStar by Memory Chips is a bit different from the other three printers previously discussed. It is available in two formats—one of the formats supports six Epson or equivalent printers, and the other supports the Okidata 84

Printer Basher, Version 1.0

Connecticut Software
Systems Corp.
30 Wilson Ave.
Rowayton, CT 06853
(203) 838-1844

List Price: \$59.95

Requires: 128K RAM, one disk drive.

CIRCLE 702 ON READER SERVICE CARD

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CIRCLE 703 ON READER SERVICE CARD

PrintMan

Qualitas
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(505) 522-0290

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Requires: 192K RAM, one disk drive.

CIRCLE 704 ON READER SERVICE CARD

PrintStar, Version 2.03

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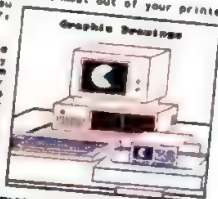
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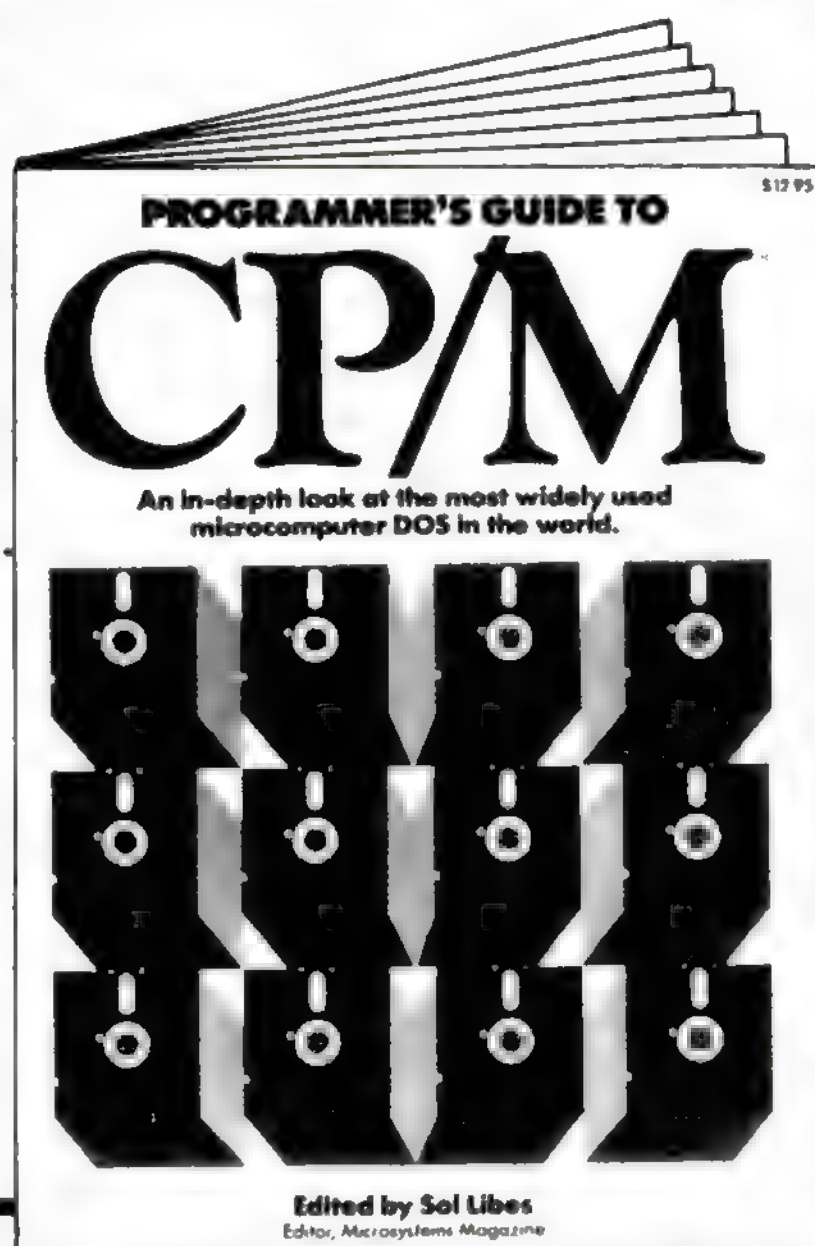
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StepII, 92, and 93. *PrintStar* doesn't have a printed manual at all; instead, a second disk includes a ten-page, on-disk manual and a four-page sample of 61 different *WordStar*/printer character sets. Although you have to print your own copies, these two files contain all the documentation you need in order to fully understand and operate the software.

PrintStar also provides several useful programs. PFont lets you create your own character sets without first drawing the characters on cross-section paper and converting the dots to control codes. VPRINT allows you to print 1-2-3, *SuperCalc*, and *VisiCalc* print files in a vertical, sideways format while controlling margins and the printer font. With INSTAR you can automatically install and modify *WordStar* for your particular printer. Finally, PMODE enables you to download printer control codes to your printer through the use of a simple menu.

The PMODE menu includes settings for the character font, print mode, left margin, line height, and form length. As you type a single letter that represents the option that you want to set, the range of acceptable options is displayed on the computer screen. You can choose from among the standard printer fonts, one of the ten alternative fonts included with *PrintStar*, or your personally designed font. When you exit the program to return to DOS, the control codes are immediately downloaded to the printer.

If you enjoy looking up printer codes, writing BASIC programs, or setting switches, you're not a likely candidate for any of these programs to help you run your printer. But if that isn't your idea of fun, *Printer Basher*, *Printerface*, *PrintMan*, and *PrintStar* all can enable you to make better use of your printer without those headaches. ■

Mark Kass is president of EHS Associates, a New Jersey-based systems consulting firm.

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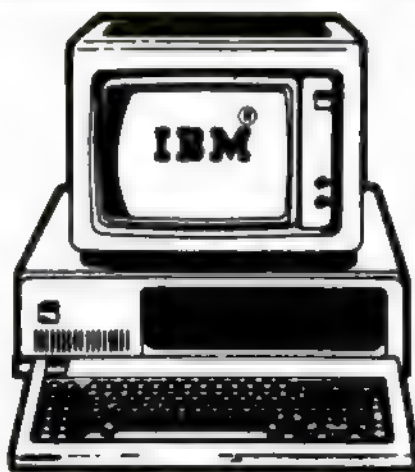
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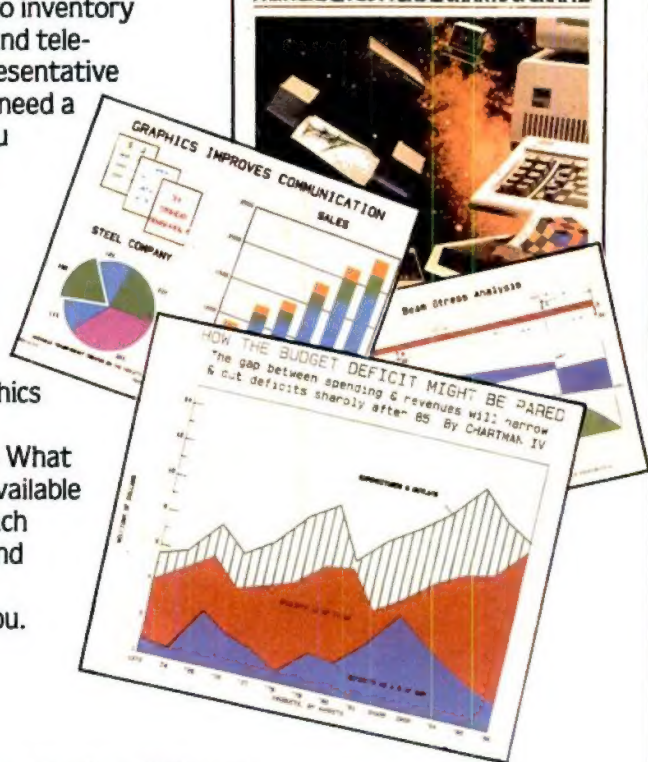
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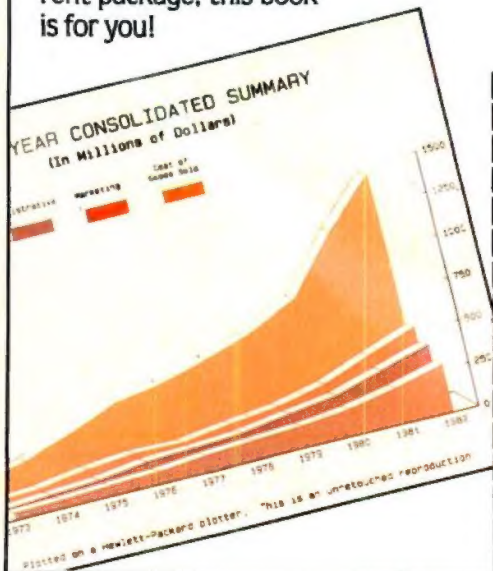
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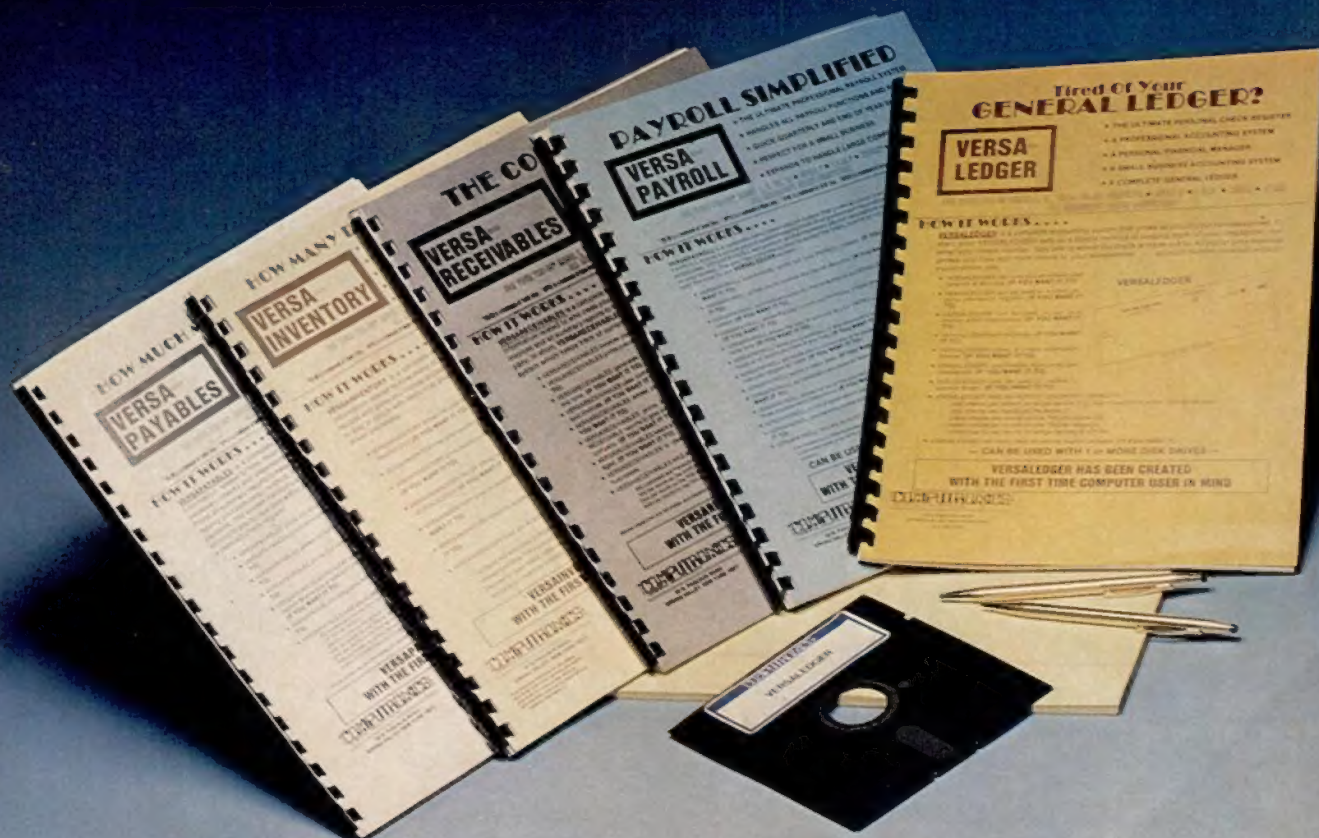
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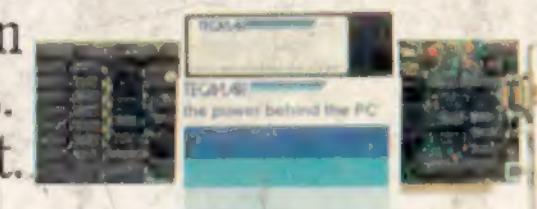
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